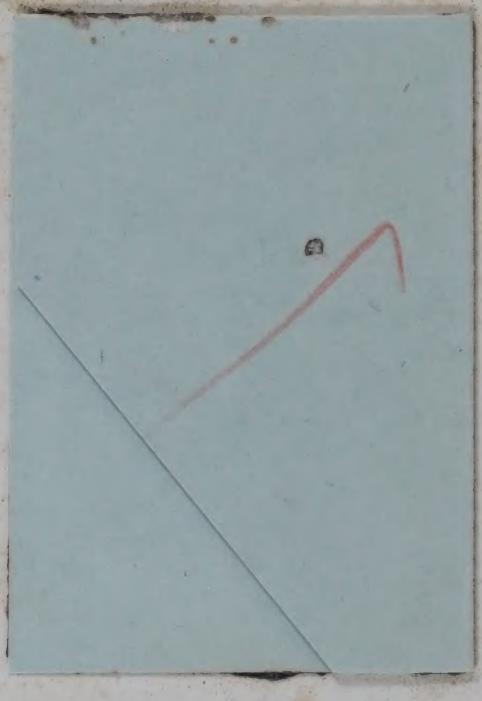

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REPORT OF THE

COMMITTEE ON NUTRITION

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REPORT OF THE COMMITTEE ON NUTRITION

PRELIMINARY

1.] In October, 1947, the Council of the British Medical Association decided to set up a Special Committee to examine the whole question of nutrition in this country and prepare an authoritative report with particular reference to the adequacy or inadequacy of the wartime and post-war diet.

2.] The Committee was constituted as follows:—

Ex-Officio Members:

Sir Hugh Lett, Bt., *K.C.V.O.*, *C.B.E.*, D.C.L., F.R.C.S., Walmer, *President of the Association*, 1947-48.

Sir Lionel E. H. Whitby, *C.V.O.*, *M.C.*, M.A., M.D., F.R.C.P., Cambridge, *President*, 1948-49.

J. B. Miller, M.D., D.P.H., Bishopbriggs, *Chairman of the Representative Body*, 1947-48.

E. A. Gregg, L.R.C.P.I. & L.M., L.R.C.S.I. & L.M., London, *Chairman of the Representative Body*, 1948-49.

H. Guy Dain, LL.D., M.D., F.R.C.S., Birmingham, *Chairman of Council.*

J. W. Bone, LL.D., M.B., C.M., B.Sc., Luton, *Treasurer*, 1947-48.

A. M. A. Moore, F.R.C.S., London, *Treasurer*, 1948-49.

The Rt. Hon. Lord Horder, *G.C.V.O.*, D.C.L., M.D., F.R.C.P., London, *Chairman.*

R. G. Gordon, M.D., F.R.C.P. Ed., Bath, *Vice-Chairman.*

Mrs. M. C. Bowley, Harpenden.

G. F. Buchan, M.D., F.R.C.P., D.P.H., London.

Harriette Chick, *D.B.E.*, D.Sc., Cambridge.

Professor S. J. Cowell, M.A., M.B., F.R.C.P., London.

Professor G. P. Crowden, *O.B.E.*, *T.D.*, D.Sc., M.R.C.S., M.R.C.P., London.

FOOD CONSUMPTION LEVELS

The statistics relating to food supplies which are included in this Report do not extend beyond the year 1947. Since the Report went to press, more recent figures have been published in *Food Consumption Levels in the United Kingdom*, Cmd. 7842 (H.M. Stationery Office, 1949). These figures show that there has been a further improvement in the diet as a result of the alleviation of certain food shortages.

3.] The Committee received valuable assistance from F. Le Gros Clark, M.A., and F. Yates, Sc.D., F.R.S., who served as co-opted members of

Sub-committees, and from the following representatives of Governmen Departments, who attended meetings of the Committee and of its Sub-committees as observers and advisers:—

E. R. Bransby, M.Sc., Ph.D., Ministry of Health.
C. J. Brown, M.A., Ministry of Food.
K. G. Fenelon, M.A., Ph.D., Ministry of Food.
H. E. Magee, M.R.C.P., D.Sc., Ministry of Health.
Percy Stocks, *C.M.G.*, M.D., F.R.C.P., General Register Office.

4.] At its first meeting, in December, 1947, the Committee appointed four Sub-committees to examine different aspects of the subject. The following acted as Chairmen of Sub-committees:—

Professor Cowell, Sub-committee on Food Consumption.
Sir Jack Drummond, Sub-committee on Nutritional Requirements.
Dr. Avery Jones, Clinical Sub-committee.
Dr. Stewart, Sub-committee on Psychological and Practical Aspects of Nutrition.

The Report of the Committee is based on the findings of these Sub-committees and is presented under the following headings:—

I. Introduction and Summary of Main Conclusions.
II. Nutritional Requirements.
III. Food Consumption in the United Kingdom.
IV. Clinical Assessment of the Nation's Health in terms of Nutrition.
V. Psychological and Practical Aspects of Nutrition.
VI. Recommendations.

The Committee wishes to express its very warm thanks to Dr. A. Macrae, its Secretary. It owes much to his hard work during the many sessions of the Sub-committees, and of the main Committee, and to his careful editing.

I INTRODUCTION AND SUMMARY OF MAIN CONCLUSIONS

5.] When the Council of the British Medical Association decided to set up a Committee on the Nation's Nutrition the wisdom and utility of such a step did not go unchallenged. Two questions were asked. Why should an inquiry be undertaken by a body which is not itself primarily concerned with research in any part of this particular field? And why try to anticipate results of a more convincing character which would doubtless be made known in time, when researches now afoot by groups eminently qualified to undertake them are completed?

6.] The answer to the first question is that, provided the Association could convene a committee which should consist of men and women deeply interested in the subject, who knew the language of science, and who were themselves engaged in certain of its aspects—a provision which quickly proved to be possible—such a body might be even better fitted to undertake a general view of the subject than a group whose work was limited to one special branch of it. The answer to the second question is that inquiries of the kind under consideration are never really completed. And yet the knowledge available at any moment is of such practical value that an "interim report" of it is well worth having. To wait for ultimate academic conviction is to deny to current Medicine and Social Economics the day-to-day service rendered by the application of well-accepted principles.

7.] Nutrition is a young and rapidly growing science. Much of the field is still unexplored or is only half explored. Today's knowledge is not the knowledge of yesterday, still less of tomorrow, and yet today's knowledge should be on record because it is the best we have by which to implement the basic facts of nutrition in terms of clinical medicine and public hygiene. If this argument is sound, it is clear that the key person concerned in the utilization of the contribution which the science of nutrition can make in the preservation of health and the control of disease is the doctor. The educationist can pull his weight by teaching the fundamental principles of nutrition in relation to physiology and chemistry. The industrialist can make his contribution through the factory canteen and the welfare service. But the opportunity given by the "close-up" of the doctor and his patient in this regard is unequalled in any other walk of life, even if, in the past, the doctor has concerned himself more with the prohibition of particular articles of diet than with the provision of positive advice.

8.] But for the doctor to be effective two things are necessary: he must be nutrition-minded and he must be properly documented. This is not the place to stress the importance of nutrition as a factor in preventing disease and in curing it; nor to lament the meagre place which the teaching of nutrition still occupies in the medical student's curriculum, that references to it are desultory and occasional and that there is no systematic teaching of the subject, as there undoubtedly should be.

9.] The Second Report of the Standing Advisory Committee on Nutrition (F.A.O., Geneva, September, 1947) contained the following paragraph: "The

Committee desires to reinforce the view that it took in its First Report—that the matter of nutrition education is one of prime importance, that it should begin with the child, that school feeding is itself a valuable means of nutrition teaching, that there are certain groups in favoured positions in relation to this matter (administrators, medical officers of health, nutritionists in public health departments, home economists, agricultural experts, food technologists, teachers, nurses and social workers), and that the family doctor, being in a key position, should be taught the principles of nutrition in his pre-clinical studies and should be familiar, throughout the whole of his clinical training, with the many ways in which degrees of malnutrition enter into disease processes." The fact that this is a Report of a Committee under the aegis of the British Medical Association, a body which has already conducted investigations in this field and made reports, endorses the view that the subject of nutrition is intimately bound up with the practice of medicine and therefore this attitude of the Association can but have a salutary effect towards bringing about the two desiderata just referred to.

10.] This Report is not a text-book on nutrition. It is, rather, a survey which will give to the intelligent inquirer the answer, in so far as the answer is known today, to questions that frequently arise on this subject. The intelligent inquirer may be a doctor, he may be a sociologist, a statesman or an educationist. The questions that arise are usually related to one of four aspects of the general problem. The first deals with the nutritional requirements for health; the second with the food that people in this country do actually consume at the present time; the third with the clinical aspects of nutrition; and the fourth with psychological and practical aspects of nutrition. These four aspects of the subject have been dealt with individually, and it has been thought best to keep separate the results of these approaches. But some general remarks are here offered in respect of the main conclusions arrived at and recommendations made.

11.] In dealing with *nutritional needs* the Committee took only conditions of health into account. It admits that there may be exceptional requirements for individuals in various groups and that available estimates lack precision, but after reviewing the extensive literature of the subject it believes that the needs of representative individuals in each group are met by the figures given. In considering calorie needs during growth, the Committee has given special attention to a grouping of ages which reflects more truly than did former groupings the physiological phases of development.

12.] Pending a more logical approach to the problem of energy for physical work, which the Committee thinks should come from a study of industrial occupations, the widely used division into "light", "heavy" and other designations is adopted, but with an attempt at more careful analysis than is usually employed.

13.] In regard to fat requirements, support is found for the view that fat should provide at least 25 per cent of the calorie value of the diet so as to maintain the general character of the food habits in this country. It would appear, again in view of the national food habits, that the percentage of calories derived from protein should not be less than 11; but in the case of pregnant and nursing women, infants, children and adolescents, it should

not be less than 14. Figures are given for the requirements for calcium and iron, vitamins and iodine, with reasons for them.

14.] The inquiry into *food consumption* employed two main sources of information: (i) estimates of the total amounts of food consumed by the population as a whole ("consumption level inquiries"); and (ii) the results of family and individual surveys. The Committee adopted a critical attitude to food surveys, and refrained from drawing conclusions from those which were small and local and those in which methods of doubtful accuracy were used. Additional facts were derived from the availability of rationed and unrationed foods and from the general character of the system of food control. From these data a picture was obtained of the nation's diet and of the way it changed during and since the war. Some remarkable figures of wartime and post-war food supplies are revealed: among the former is the increase in the supply of milk. The Committee considers that the nature of the national diet has undergone a substantial change; witness the fact that before the war 34 per cent of the total calorie supplies came from potatoes and grain, whereas in 1946 this increased to 42 per cent. The figures on nutrient supplies are equally striking. Supplies of total protein, minerals and some vitamins have increased considerably as compared with pre-war supplies. There is, however, a dearth of information as to the adequacy of the food consumed by particular sections of the population. For instance, it cannot be stated if "heavy" workers, through boredom with the starchy foods from which a larger proportion of their calorie requirements was necessarily derived, so limited their intake of these foods that they suffered in health, or maintained health only at the expense of output.

15.] In dealing with the *clinical assessment of the nation's health in terms of nutrition*, the Committee analysed the available evidence on vital statistics, growth and development, and the clinical and biochemical data of malnutrition. It is shown that, after a temporary setback in 1940-1, the death rate fell, below the pre-war trend, to record levels in 1946-8. Of infant mortality the same may be said.

16.] Information on the heights and weights of school children show that their growth rates were maintained or increased during the war but tended to fall back in 1945-7. The conclusions reached in respect of various other groups (e.g., pre-school children, housewives, industrial workers, the aged) are punctuated by repeated references to the paucity of the data available. The Committee urges that the whole matter of the clinical methods of assessing nutrition be subjected to more investigation and research.

17.] The conclusion of this particular part of the Report is significant: "It is difficult to estimate what part, if any, of the high standards of health achieved since the outbreak of war is due to changes in the diet. . . . Having regard to all the facts . . . before the Committee it would appear to be a fair conclusion that the health of the population as a whole, despite the trials and tribulations of recent years, has been well maintained."

18.] When dealing with the *psychological and practical aspects of nutrition*, as the result of a very full examination of the field presented to it, the Committee makes certain recommendations, which are summarised on pages 105-6. It stresses the value of variety in the national diet, and the importance of priority food (especially milk) for school children in their homes during

school holidays and for industrial workers (especially adolescents) to whom canteen or civic restaurant facilities are not available. It urges the speedy extension of meals delivery services for old people; the organization of special catering departments in hospitals, with canteen facilities for out-patients; improved training for prospective teachers of domestic science to make them better acquainted with the home background of the ordinary pupil; allocation of more foodstuffs for cookery demonstrations; and the institution of an inquiry by a competent investigator into what fundamental changes, if any, have occurred in the food habits of young people (15–25) as a result of the diet of recent years.

19.] The Committee presents this Report in the belief that the combined approach already referred to achieves as full and as accurate a measure of the nation's nutritional state as the available facts permit. It does not conceal that these facts are, in some places, too meagre to yield conclusions that carry complete conviction. Indeed, that there are gaps and guesses here and there is freely admitted. It appears to the Committee that a permanent organization might with advantage be established for the purpose of keeping a continuous check on the nutritional state of the population and investigating the many unsolved nutritional problems.

20.] But the picture produced is, on the whole, not unsatisfactory, in the view of the Committee, bearing in mind the stress and strain of the past few years and the severe shortages in food with which the country has been faced.

II NUTRITIONAL REQUIREMENTS

1. INTRODUCTORY

21.] The Committee reviewed an extensive literature dealing with the nutritional requirements of man. What follows represents the conclusions derived from consideration of the data there recorded. These conclusions concern the needs of healthy individuals. The Committee did not consider that its terms of reference covered examination of the special food requirements of the sick or convalescent. There is, therefore, in this Report no treatment of such important questions as the influence of high levels of protein consumption on recovery from burns, fractures and surgical treatment or the increased requirement for ascorbic acid believed to be associated with some febrile conditions.

22.] The calorie estimates and quantities of various nutrients recommended are believed to be sufficient to establish and maintain a good nutritional state in representative individuals of the groups concerned. It is recognized that in every group there must be cases where the need for one or other nutrient is greater than that of the average.

23.] The Committee wishes to emphasize the urgent need for further extensive study of human nutritional requirements. A survey such as it has made reveals many gaps in the existing knowledge of the quantitative aspect of man's needs.

2. ENERGY REQUIREMENTS

24.] The Committee wishes to draw attention to the need for more detailed information concerning the wide range of energy requirements within groups of the population, divided according to sex, age or occupation. Until data suitable for statistical treatment are available the choice of a calorie allowance for any one group must be to a large extent an uncertain one.

25.] To say this is not to cast serious doubt on the value of the calorie estimates that have been widely used in recent years in calculating the amount of food needed to nourish large groups of people, but is intended to emphasize the fact that such estimates lack precision. On the other hand, the wide and varied experience of problems of nutrition gained since 1939 provides convincing evidence that these calorie estimates were certainly of the right order of magnitude.

26.] The calorie estimates set out in Tables I (a) and I (b) represent the Committee's considered judgment based on a large mass of data. In general, there is agreement with those derived by the Technical Commission of the League of Nations (1938) and with the "Recommended Allowances" of the Food and Nutrition Board of the National Research Council of the United States (1941,* revised 1945 and 1948). It should be recognized that each figure in Tables I (a) and I (b) is an average representing the range of calorie intakes of the particular group.

Calorie Needs during Growth

27.] The Committee has derived figures relating to age and sex from a

* Published in 1943.

smooth curve based on data taken from the literature and from a considerable quantity of unpublished records of food consumption of well nourished, healthy children (Table I (a)). It is often convenient, when assessing the energy requirements of a large number of children, to use one figure to cover a group of ages. For this purpose the Committee has made a grouping of ages that it believes reflects the physiological phases of development (Table I (a), Column 2).

Energy Needs of Adults

28.] As a basis for consideration of the needs of adults it is useful to accept the estimates of 2,200 and 1,800 Calories a day for adult males and females respectively, as being the amount of energy required for 24 hours of ordinary living, apart from any special form of physical activity. These figures are derived in the following manner:—

	Male	Female
	(5 ft. 6½ in.—168·5 cm.) (143 lb.—65 kg.)	(5 ft. 2 in.—157·5 cm.) (123 lb.—56 kg.)
Basal metabolism+SDA*	1,700	1,400
Sixteen hours general daily activity ("up and about", dressing and undressing, etc.)	+370=2,070	+300=1,700
Travelling by foot, 2 miles (walking at 3 m.p.h.=150–200 Cals./hr. extra)	+130=2,200	+100=1,800

* *SDA.* This addition is made to the basal requirements to allow for the specific dynamic action of foods.

Energy for Physical Work

29.] The Committee attempted to find a more satisfactory means of indicating the range of energy requirements as related to physical activity than that based on an arbitrary grouping of "light", "heavy" and "very heavy" work. Such groupings, although they have been widely employed as the basis for systems of differential rationing, are not only indefensible on scientific grounds, but also raise many difficult sociological and political problems.

30.] Among adults there is every grade of physical effort from that of the adult woman "up and about", whose average needs are estimated at 1,700 Calories a day, to that of a man doing exceptionally hard physical work, whose expenditure may be even greater than 5,000 Calories during a day's activity. The logical approach to this problem is to attempt to classify those engaged in physical work according to their average expenditure of energy per working hour and the number of hours of work. But it has to be admitted that there are available comparatively few data concerning conditions of work in this country that can be used for such a purpose. There is an urgent need for more information of this kind. When this knowledge is available it may eventually be possible to produce a list of industrial occupations for each of which an appropriate average calorie assessment can be assigned. Until then, there appears to be no alternative, even of a provisional character, to continuing to use the objectionable but widely used classification into "light", "heavy" and other rough and ready designations of physical activity.

31.] Accepting this view, the Committee considers it appropriate to divide adults into six groups of males and five of females according to the demand for energy made by the nature of their work:—

Type of Activity	Additional Calories per hour	
	Males	Females
Sedentary, some small physical activity	30	30
Light effort	70	70
Moderate effort	100	100
Heavy effort	200	200
Very heavy effort	300	300
Exceptionally heavy effort	450	—

32.] In computing the energy needs for physical effort classified as "light" or "moderate", given in Table I (b), it has been assumed that eight hours' actual work are involved. While carrying out more arduous work it is customary for the worker to take short pauses for rest. An attempt to allow for this has been made in assessing the needs of "heavy", "very heavy" and "exceptionally heavy" physical activity. The figures thus derived are set out in Table I (b).

33.] In any one group of a conventional classification of this kind there is, naturally, a wide range of individual energy expenditures, but the assessments given in Table I (b) can be accepted as approximations to the average daily calorie requirement for physical effort of the magnitude described under the separate headings. It is also important to bear in mind that the above classification of physical effort is related to different calorie expenditures per hour. This gives a measure of definition to the designations "light", "heavy", etc. Unless there is such definition these terms may be misleading. Thus, the Food and Nutrition Board of the National Research Council (U.S.) give 4,500 Calories daily as the "recommended allowance" for a "man with heavy work". Such an evaluation is not comparable with the figures of 3,500 and 4,250 Calories daily, which the Committee derives from estimates of "heavy" work at two levels of expenditure, 200 and 300 Calories per hour respectively.

Classification of Workers

34.] The Committee gave much thought to the difficult problem of classifying, according to the groups set out above, the wide diversity of industrial work and other kinds of physical activity. With the small volume of data now available the problem is insoluble. Some of the records in the literature are now of small value because they concern work carried out under conditions by no means comparable with those of today. The rapid expansion of the use of labour-saving devices in industry tends progressively to reduce the average calorie expenditure of the workers they affect.

35.] The limited amount of data concerning energy expenditure in industries as they operate in this country today makes it a matter of no little uncertainty how to classify appropriately certain designations such as "miner", "heavy engineering worker" and "farm-worker". Each such designation covers different types of activity involving degrees of physical effort ranging at least from "moderate" to "very heavy" work.

Relation of "Meal Pattern" to Working Efficiency

36.] The Committee is satisfied that a thorough study of the relation of the distribution of the daily calorie intake to working efficiency, particularly in

"heavy" industries, would reveal much of practical importance. A few investigations have been carried out on this question, for the most part in the U.S.A., but many more remain to be undertaken.

3. FAT IN THE DIET

37.] The relatively high calorie value of fats is of special importance when the energy expenditure of the body is large. A diet that is to meet the demands of heavy physical work may be too bulky for those unaccustomed to it if there is only a small proportion of fat. Apart from their significance as sources of energy, fats influence the nutritional state by providing, in some cases, fat-soluble vitamins and also by facilitating their absorption from other foods.

38.] Whatever views may be held regarding the strictly nutritional function of fats, it is generally accepted that their psychological significance, in relation to food habit, is great. This is particularly true of "visible" fats (butter, margarine, lard and cooking fats).

39.] There is no convincing evidence that any individual fatty acids are indispensable for the nutrition of man, although it is well established that rats show signs of ill-health if their diet lacks certain unsaturated acids. The Committee is inclined to accept the view that the relatively simple type of diet that has been enforced in this country by wartime and post-war restrictions has provided all that is required in the form of "essential fatty acids" if, in fact, they are of importance in human nutrition.

40.] Whilst the Committee is unaware of any evidence that there is a minimum daily intake of fat required to maintain the health and well-being of the human body, it finds ample support for the opinion that fat ("visible" and "invisible") should provide at least 25 per cent of the calorie value of the diet in order to maintain the general character of the food habits of the people of the United Kingdom. If the diet is not to become bulky and unsatisfying it is appropriate to increase this proportion to about 35 per cent as the energy demands of the body rise with increasing physical effort.

4. PROTEIN

41.] The Committee has made a critical analysis of the evidence regarding man's need for protein. It considers that, in the present state of knowledge, it is prudent to view the matter in the light of the dietary habits of the community and to pay particular regard to the proportion of calories derived from protein. The Committee takes the view that the average protein requirements of groups of individuals cannot yet be assessed with any certainty.

42.] There are good reasons for believing that man's need for protein at different ages and under different conditions will not be defined until it is known how many of the individual amino-acids and other protein units are indispensable for his nutrition and in what amounts. The task of obtaining this information is a formidable one.

43.] It is generally accepted that it is immaterial whether the essential protein units are derived from plant or animal foods, provided that they supply an appropriate mixture of the units in assimilable form. There is at the present time no convincing evidence that animal protein has an intrinsic

value of its own. The Committee, however, draws attention to the important fact that the nutritional value of animal foods may in many instances be determined in no small measure by the presence of nutrients other than protein and, moreover, that this consideration has not been sufficiently taken into account in the past when the respective merits of animal and vegetable protein have been compared.

44.] With this background the Committee was reluctant to adopt any estimates of protein allowances expressed as grams per day. A strong objection to figures of this type arises from the fear that, whatever reservations may have been in the minds of those who originally proposed their use, there is a tendency for such figures to become regarded as estimates of human *requirements*. The more closely they are examined the more clearly does it emerge that they represent little more than intelligent guesswork as to the quantities of protein which will amply cover man's need.

45.] It being undesirable, in the opinion of the Committee, that a misleading impression of precision and finality should be given by endorsing such figures as the widely used 1 gram of protein per kilogram of adult body weight, or by recommending the use of similar estimates, an alternative approach to the problem was made by considering protein intakes in relation to calorie intakes. At first sight, this may appear to be a retrograde step, but it will be found to have much to recommend it if it is considered in the light of the lack of precise knowledge of human protein requirements, the quality of the mixture of proteins provided by the food and eaten by the people of the United Kingdom, and the record of food consumption in its relation to national health and welfare during the past ten years (see Section IV).

46.] It must be clearly recognized that, in what follows, the Committee is not concerned with human protein *requirements*. As pointed out above, these are not known and cannot yet be assessed. The analysis of diets that led to the recommendations in this paragraph was concerned solely with determining what intakes of mixed protein, derived from typical U.K. dietaries, are compatible with health and well-being. These recommendations are based on the evidence indicating that growth and health were on the whole well sustained between 1940 and 1945. During this period the energy derived from protein generally represented between 10 and 14 per cent of the total calories. Very few diets exist in which the proportion of the calories derived from protein falls below 10 per cent, and the level for a particular population tends to remain constant at all ages (except infancy) and at all grades of muscular activity. On the whole, people eat more or less of a mixed diet according to energy requirement. Although the requirement of protein is related to sex, body size, growth, pregnancy and lactation, but not to physical work, it is convenient to pay regard to the proportion of the total calories derived from protein. The Committee believes that 14 per cent of the calories in the form of protein of a mixed diet is sufficient for pregnant and nursing women, infants, children and adolescents. For adults (other than pregnant and nursing women) not engaged on hard work, the Committee recommends that the diet should provide not less protein than an amount representing 11 per cent of the energy allowance.

47.] The Committee appreciates that this method of appraising protein intakes leaves much to be desired. At either end of the range of calorie intakes it produces figures for protein intake that are respectively abnormally high

or low by conventional standards. The Committee, however, knows of no reason for believing that an exceptionally heavy worker, expending 5,000 Calories or more a day, will be any the worse for consuming 150 grams of mixed diet proteins; indeed, unless his diet were unusually rich in fats it would be difficult for him to get 5,000 Calories without taking in well over 100 grams of protein. At the other extreme, there is the case of the sedentary woman with a calorie expenditure of about 2,000 a day. Eleven per cent of that intake as proteins would represent about 60 grams daily; a quantity of mixed dietary proteins well above that required to maintain nitrogen equilibrium. Whether this amount would be sufficient for all the body's needs is not known, but the evidence of the wartime years suggest that it would.

48.] The Committee regrets that it has not found it possible to present a clearer picture of this aspect of the human body's needs. It believes that the simple relationship between energy and protein intakes, referred to in paragraph 46, will prove a safe practical guide in studying and appraising food consumption and diets in the United Kingdom.

5. CALCIUM

49.] The Committee has found no little difficulty in reaching a decision regarding the desirable intake of calcium. On the one hand, the results of careful surveys of the literature made during recent years are together regarded as reasonably good justification for accepting the figures put forward by the Food and Nutrition Board of the National Research Council (U.S.) in 1945. On the other hand, the Committee is impressed by the growing body of evidence indicating that the human body readily adapts itself to live economically and effectively at levels of calcium intake considerably lower than those represented by these figures.

50.] After careful consideration it has been agreed that there are not yet sufficient quantitative data regarding maintenance of good calcium balances on relatively low intakes to justify a departure from the National Research Council (1945) recommended allowances of calcium. The Committee is not impressed by the arguments that led the National Research Council in its recent revision (1948) to raise the calcium allowance for adults from 0·8 to 1·0 g. a day.

6. IRON

51.] The recommended allowances of the National Research Council (1945) are thought to be appropriate, although the Committee is of opinion that a great deal about iron requirements of the human body remains to be discovered.

7. VITAMINS

Vitamin A

52.] A review of evidence concerning human requirements, in particular that obtained in the study carried out in 1943–5 by the Medical Research Council, and that derived from an examination of wartime diets in the United Kingdom, has led the Committee to adopt the figures set out below. The figures, especially those recommended for pregnancy and nursing, are based on slender evidence.

VITAMIN A DAILY

Children (15 years and under)	Vitamin A	1,500 i.u. or
	Carotene	4,500 i.u. or
	"mixed diet" 1/3 Vitamin A and 2/3 Carotene	3,000 i.u.
Adolescents and Adults	Vitamin A	2,500 i.u. or
	Carotene	7,500 i.u. or
	"mixed diet" 1/3 Vitamin A and 2/3 Carotene	5,000 i.u.
Pregnancy	Vitamin A	3,000 i.u. or
	Carotene	9,000 i.u. or
	"mixed diet" 1/3 Vitamin A and 2/3 Carotene	6,000 i.u.
Lactation	Vitamin A	4,000 i.u. or
	Carotene	12,000 i.u. or
	"mixed diet" 1/3 Vitamin A and 2/3 Carotene	8,000 i.u.

Thiamine (Aneurin, Vitamin B1)

53.] There is clear evidence of a direct relationship between the body's requirement for thiamine and its calorie expenditure. There is also substantial support for expressing the relationship in terms of thiamine and calories derived from carbohydrate and protein, sometimes referred to as "non-fat" calories.

54.] Having regard to the fact that diets in this country have for the past seven years provided from 25 to 30 per cent of calories in the form of fat (total "visible and invisible" fats) and are unlikely to change in character for the next year or two, the Committee accepts the following basic estimates of thiamine requirement for all population groups except nursing mothers:

0·4 mg. per 1,000 total Calories.
0·6 mg. per 1,000 non-fat Calories.

These factors can be applied to all groups except nursing mothers, for whom a supplement is recommended. Study of the conditions required to maintain the vitamin B1 content of human milk at an appropriate level indicates that the intake of 1·2 mg.—calculated on the basis of the energy equivalence of the diet (3,000 Calories)—should be supplemented by 0·2 mg. to give a total of 1·4 mg. daily.

Riboflavin and Nicotinic Acid (Niacin)

55.] The evidence that these two vitamins are also required by the body in quantities related directly to the calorie expenditure is hardly more than suggestive, but the Committee is prepared to make a recommendation on that basis:

Riboflavin	0·6 mg. per 1,000 Calories
Nicotinic Acid (Niacin) ..	4 mg. per 1,000 Calories

As in the case of thiamine, the Committee considers that evidence derived

from studies of the composition of human milk justifies a recommendation that the following supplements to the quantities based on calorie intakes should be provided during lactation:

Riboflavin	0·3 mg. daily
Nicotinic Acid	2 mg. daily

The recommended daily intakes for nursing women would, therefore, be 2·1 mg. of riboflavin and 14 mg. of nicotinic acid daily.

Other B Vitamins

56.] The Committee is of opinion that it is not yet possible to assess human needs for folic acid, pyridoxin, pantothenic acid, biotin and other recently discovered components of this group of nutrients.

Vitamin C

57.] The Committee was unable to find any trustworthy evidence that maintenance of saturation of the blood with vitamin C was desirable in the interest of health. The large "recommended allowances" of 75–100 mg. daily, advocated by the National Research Council (1945 and 1948), which are related to maintaining saturation of the blood, were not, therefore, thought to be necessary. The Committee's views were strongly influenced by records of food consumption in the United Kingdom during the past eight years and, in particular, by the special investigation carried out in 1944–6 by the Medical Research Council. This study revealed that 10 mg. of ascorbic acid daily prevented the appearance of signs of scurvy in human adult volunteers, and also caused signs of that disease to disappear rapidly after they had been produced by a restricted diet.

58.] In view of these and closely related findings by others who have investigated scurvy in man, the Committee is of opinion that, while 20 mg. a day or even less may be an adequate quantity for adults, 30 mg. daily would provide a good margin of safety. During pregnancy the larger intake of 40 mg. daily is advised, whilst during lactation an intake of at least 50 mg. daily is required to maintain an appropriate ascorbic acid concentration in mother's milk.

Vitamin D

59.] Much more information is needed regarding human requirements, in particular those of adults and especially of pregnant and nursing women. The Committee suggests, after reviewing the evidence, that the following allowances be adopted tentatively:

Children 0–2 years	800 i.u. daily
Children over 2 years ..	400 i.u. daily
Pregnant women	400–600 i.u. daily
Nursing women	800 i.u. daily

Under ordinary conditions adults need vitamin D, but there are no clear indications of the quantity required for health.

8. IODINE

60.] The Committee was guided to a large extent by the data reported in a

recent publication of the Medical Research Council on thyroid enlargement (1948). The daily requirement appears to be of the order of 100μg. daily for adults. A larger amount, 150μg. daily, may be advisable for children, adolescents and pregnant and nursing women.

9. *PER CAPITA* REQUIREMENT

61.] If trustworthy estimates are available of the proportions of the population represented by the various age and physical activity groups, it is possible to calculate from data such as are given in Appendix A what are the "weighted" *per capita* requirements of the population as a whole. Such *per capita* figures, if their derivation inspires confidence, are of great value in studying and comparing national food consumptions.

62.] Unfortunately, trustworthy information about the composition of the population in this sense is usually very difficult to obtain. During the years of the war, when it was important to have *per capita* figures for many basic investigations, there were good statistical data concerning the numbers of children in each age group and of pregnant and nursing women, but there was scanty information on which to base a division of the adult population according to their physical activity. There was in fact no practical alternative to working on the assumption that the adult population, taken as a whole, with the exception of pregnant and nursing women, could be regarded as "moderately active", with daily requirements of 3,000 Calories for men and 2,500 Calories for women, as advocated by the National Research Council (U.S.) in 1941.

63.] There are grounds for believing that this assumption does not involve a major inaccuracy, although this is no place to discuss the question in detail. It would obviously be preferable to have a more substantial foundation for calculating the *per capita* need, but with the data available it was calculated that the daily *per capita* requirement of the United Kingdom civilian population was 2,550 Calories in 1944. As a weighted estimate this figure covered every type of individual energy needs from those of infants to those of persons engaged in very heavy physical work. The position is no better today than it was in 1944. There is insufficient information on which to base an appropriate classification of the adult population in accordance with nutritional needs.

64.] With reservations regarding the propriety of assuming that the adult population can be taken as a whole as "moderately active", in the sense in which the term was employed by the Food and Nutrition Board of the National Research Council (U.S.) in 1941, the estimate of 2,550 Calories as the *per capita* need of the entire population of the United Kingdom can be accepted as a useful reference figure. It, and other similar *per capita* estimates, with all their defects, are the only figures that should be used for making comparisons with estimates derived from analyses of bulk food supply statistics; they are not comparable with figures representing individual requirements or intakes which a particular person might need. This fact is often misunderstood or ignored.

65.] Finally, to present the whole nutritional picture, there are given the *per capita* requirements of the United Kingdom 1948 population calculated

(1) according to the National Research Council "Recommended Allowances" (1945), and (2) according to the estimates put forward in this Report.

	(1) N.R.C. Recommended Daily Allowances 1945	(2) B.M.A. Recommendations 1949
Calories	2,564	2,554
Protein (g.)	65	71
Calcium (mg.)	917	917
Iron (mg.)	11·8	11·8
Vitamin A (i.u.) (mixed diet)	4,460	4,570
Thiamine (mg.)	1·27	1·02
Riboflavin (mg.)	1·74	1·53
Niacin (mg.)	12·7	10·2
Vitamin C (mg.)	71	20–30
Vitamin D (i.u.) .. .. (assuming adults have a requirement of zero and all children and adolescents have the children's requirement)	130	150

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APPENDIX A

TABLE I(a)

Daily Calorie Allowances during Growth

Category (age last birthday)	(1) Recommended	(2) Grouped for age
Child age 0	800	1,000
,, ,, 1	1,150	
,, ,, 2	1,300	
,, ,, 3	1,400	
,, ,, 4	1,500	1,500
,, ,, 5	1,600	
,, ,, 6	1,700	
,, ,, 7	1,800	
,, ,, 8	1,900	2,000
,, ,, 9	2,100	
,, ,, 10	2,250	
Girl ,, 11	2,450	
,, ,, 12	2,650	2,750
,, ,, 13	2,850	
,, ,, 14	2,800	
,, ,, 15	2,600	
,, ,, 16	2,500	
,, ,, 17	2,500	2,500
,, ,, 18	2,500	
,, ,, 19	2,500	
,, ,, 20	2,500	
Boy ,, 11	2,450	
,, ,, 12	2,650	2,750
,, ,, 13	2,860	
,, ,, 14	3,130	
,, ,, 15	3,400	
,, ,, 16	3,560	
,, ,, 17	3,620	3,500
,, ,, 18	3,580	
,, ,, 19	3,360	
,, ,, 20	3,000	

TABLE I (b)

Daily Calorie Allowances for Adults

Requirement class	Description	Calorie reqt.	Simple Computation					Detailed Computation					
			BMR + SDA	Up-and-about for 16 hrs.	Travelling	Work	Total	BMR	Calcd. SDA	Up-and-about for 16 hrs. less work hours	Travelling	Work	Total
Men													
0	No work, almost basal (e.g., lying in bed)	1,750	1,700	0	0	0	1,700	1,600	165	0	0	0	1,765
1	Sedentary work (30 Cals./hr.) and little travelling (65 Cals.)	2,250	1,700	370	65	240	2,375	1,600	185	184	65	240	2,274
2	Light work (70 Cals./hr.) and travelling (130 Cals.) ..	2,750	1,700	370	130	560	2,760	1,600	207	184	130	560	2,681
3	Medium work (100 Cals./hr.) and travelling (130 Cals.) ..	3,000	1,700	370	130	800	3,000	1,600	218	184	130	800	2,932
4	Heavy work (200 Cals./hr.) and travelling (130 Cals.) ..	3,500	1,700	370	130	1,300	3,500	1,600	239	218	130	1,300	3,487
5	Very heavy work (300 Cals./hr.) and travelling (130 Cals.)	4,250	1,700	370	130	1,950	4,150	1,600	271	218	130	1,950	4,169
6	Extremely heavy work (450 Cals./hr.) and travelling (130 Cals.)	5,000	1,700	370	130	2,700	4,900	1,600	302	230	130	2,700	4,962
Women													
0	No work, almost basal (e.g., lying in bed)	1,500	1,400	0	0	0	1,400	1,300	138	0	0	0	1,438
1	Sedentary work (30 Cals./hr.) and little travelling (50 Cals.)	2,000	1,400	300	50	240	1,990	1,300	159	152	50	240	1,901
2	Light work (70 Cals./hr.) and travelling (100 Cals.) ..	2,250	1,400	300	100	560	2,360	1,300	170	152	100	560	2,282
3	Medium work (100 Cals./hr.) and travelling (100 Cals.) ..	2,500	1,400	300	100	800	2,600	1,300	182	152	100	800	2,534
4	Heavy work (200 Cals./hr.) and travelling (200 Cals.) ..	3,000	1,400	300	100	1,200	3,000	1,300	203	190	100	1,200	2,993
5	Very heavy work (300 Cals./hr.) and travelling (100 Cals.)	3,750	1,400	300	100	1,800	3,600	1,300	234	190	100	1,800	3,624

TABLE I (c)

SUMMARY OF DIETARY ALLOWANCES AS RECOMMENDED BY THE COMMITTEE

Age and Sex	Requirement class	Calories daily	Protein g. daily	Iron mg. daily	Calcium g. daily	Vit. A and Carotene i.u. daily	Vit. D i.u. daily	Thiamine mg. daily	Niacin mg. daily	Riboflavin mg. daily	Vit. C mg. daily	Iodine μg. daily
Both—												
0–1		1,000	37	6·5	1·0	3,000	800	0·4	4	0·6	10	—
2–6		1,500	56	7·5	1·0	3,000	400	0·6	6	0·9	15	150
7–10		2,000	74	10·5	1·0	3,000	400	0·8	8	1·2	20	150
Males—												
11–14		2,750	102	13·5	1·3	3,000	400	1·1	11	1·6	30	150
15–19		3,500	130	15·0	1·4	5,000	400	1·4	14	2·1	30	150
20+	0	1,750	51	12·0	0·8	5,000		0·7	7	1·0	20	100
	1	2,250	66	12·0	0·8	5,000		0·9	9	1·4	20	100
	2	2,750	80	12·0	0·8	5,000		1·1	11	1·6	20	100
	3	3,000	87	12·0	0·8	5,000		1·2	12	1·8	20	100
	4	3,500	102	12·0	0·8	5,000		1·4	14	2·1	20	100
	5	4,250	124	12·0	0·8	5,000		1·7	17	2·6	20	100
	6	5,000	146	12·0	0·8	5,000		2·0	20	3·0	20	100
Females—												
11–14		2,750	102	13·5	1·2	3,000	400	1·1	11	1·6	30	150
15–19		2,500	93	15·0	1·1	5,000	400	1·0	10	1·5	30	150
20+	0	1,500	44	12·0	0·8	5,000		0·6	6	0·9	20	100
	1	2,000	58	12·0	0·8	5,000		0·8	8	1·2	20	100
	2	2,250	66	12·0	0·8	5,000		0·9	9	1·4	20	100
	3	2,500	73	12·0	0·8	5,000		1·0	10	1·5	20	100
	4	3,000	87	12·0	0·8	5,000		1·2	12	1·8	20	100
	5	3,750	109	12·0	0·8	5,000		1·5	15	2·2	20	100
Pregnancy—												
First half		2,500	93	12·0	0·8	6,000	400	1·0	10	1·5	40	150
Second half		2,750	102	15·0	1·5	6,000	600	1·1	11	1·6	40	150
Lactation		3,000	111	15·0	2·0	8,000	800	1·4	14	2·1	50	150

NOTE.—The nutritional allowances adopted by the Committee agree closely with those adopted during the war by the Oxford Nutrition Survey; these were made available to the Committee by Dr. H. M. Sinclair and are shortly to be published. Where there is disagreement in comparable cases between the two, Dr. Sinclair himself prefers the figures of the Oxford Nutrition Survey. They are included in *Malnutrition and Starvation in Western Netherlands*, Part II, Table 4 (The Hague: State Printing Office, 1948).

III FOOD CONSUMPTION IN THE UNITED KINGDOM

1. SOURCES OF INFORMATION

66.] Information on food consumption and nutrient intakes comes directly from two sources: (1) estimates of the total amounts of foods consumed by the population as a whole; and (2) results of family and individual food surveys. In addition, there is indirect evidence from estimates of the availability of rationed and unrationed foods and from the general character of the system of food control. In the paragraphs which follow the Committee considers the kinds of data derived from these various sources before discussing the information which has in fact been obtained.

Consumption Level Inquiries

67.] Studies of the amounts of food consumed by the population as a whole are commonly known as "consumption level inquiries". Estimates of the amounts of foods entering consumption are based on estimates of the home production, of imports and exports of the various foods, of changes of stocks and of amounts used for purposes other than the feeding of the population. There are several stages of the distributive process to which the figures can relate, but the data presented by the Ministry of Food for the United Kingdom show the quantities entering shops and catering establishments. By the use of appropriate tables of food composition, the amounts of nutrients in these quantities of food can be calculated. Calculations can also be made of the nutrient requirements of the population as a whole, according to its sex and age distribution.

68.] These two sets of data, the nutrients entering the retail stage of distribution and the nutrient requirements of the population, cannot directly be compared as the requirements relate to the nutrients actually eaten; but by allowing for factors such as wastage, broad comparisons can reasonably be made. Moreover, changes in the food supplies over a number of years will be reflected in the figures, provided that allowance is made for any changes which may have occurred in the rate of wastage. The precision of the calculations depends on the reliability of the basic data. The error in the estimates of the quantities moving into consumption is probably small for the staple foods; but for certain foods, such as fruit and vegetables, it may be large. For the United Kingdom, the calculations of the amounts of nutrients in the food supplies, although subject to a series of errors in the primary estimates as well as in subsequent allowances for wastage, are substantially accurate.

Dietary Surveys

69.] These surveys are of two kinds: (1) family surveys, in which information is collected on the amounts of food eaten by each family as a whole; and (2) individual surveys, in which the information relates to the amounts of food eaten by selected individuals. Recently there has been controversy on

the relative value of these two types of survey, but the Committee wishes to stress that they should not be considered as alternatives or competitors, but as two distinct methods of survey, each providing a particular kind of information. There can be no doubt of the value of surveys of large groups of individuals; on the other hand, the family is the basic unit of modern life. The proper exploitation of both methods of survey will throw better light on the problems of nutrition than either method alone.

70.] There are important differences in the information derived from "consumption level inquiries" and from dietary surveys, and comparison cannot be made without great caution. The data derived from "consumption level inquiries" relate to the population as a whole and to the foods entering the retail stage of distribution; dietary surveys provide data on the foods eaten in the home or purchased for home consumption by selected groups of the population, but do not measure directly the amount of food eaten outside the home.

71.] If, however, a sufficiently large and representative sample of the whole population could be studied in a food survey, and if all the foods eaten were accurately recorded, then the results from that survey and those from a "consumption level inquiry" might be expected to be in agreement, after allowance had been made for the stages in the distributive process to which they related, for meals eaten outside the home and for other factors. If the sample surveyed is in any way unrepresentative, there will be a "gap" between the results obtained from the two forms of inquiry. The "gap" which exists between the results from the Ministry of Food's "consumption level inquiry" and those from its National Food Survey has caused a good deal of confusion. It is discussed in some detail in Appendix C.

The System of Food Control

72.] A study of the system of food control in recent years, while providing no direct information, gives a good deal of indirect information on some of the changes in the nation's food supplies. This system of control, both during and since the war, has been based as far as was practicable on nutritional principles, and certain features of the system must have had a powerful effect on the distribution of the available foods between the various sections of the population. Among these are the national milk scheme, the milk in schools scheme, the vitamin scheme, the raising of the extraction rate of flour and its fortification with calcium, the fortification of margarine with vitamins A and D, the impetus given to the consumption of potatoes and vegetables, and the extension of communal feeding in works canteens and British Restaurants. Moreover, rationing has meant the sharing of many foods more evenly among all sections of the population; and price control, full employment and improving wage levels have meant that rations and similar allowances could be bought at least by the great majority of persons.

Availability of Rationed and Unrationed Foods

73.] A number of estimates have been made of the amounts of rationed and similarly controlled foods available to persons of different sex, age and occupation, and of the amounts of unrationed foods which they can reasonably obtain. Another method of inquiry has been to examine, by considering the availability and price of foods in the shops, whether or not working-class

families could, in fact, get enough to eat. No matters of special complexity arose in connection with these estimates. The former type of inquiry, of course, deals broadly with the problem and with the population as a whole; the latter is an entirely practical approach and takes account of the actual situation which confronts the housewife.

2. FOOD CONSUMPTION LEVELS

74.] Assessment of food consumption levels is most readily made in the form of national averages of food moving into consumption, obtained by dividing home-produced supplies and imports, after adjustment for changes in stocks, by the number of the population concerned, and thus arriving at the average supplies per head. The method used by the Ministry of Food in calculating the national averages is that devised and used by the Special Joint Committee of experts set up by the Combined Food Board in 1943, and is described in detail in the first report of that committee, "Food Consumption Levels in the United States, Canada and the United Kingdom" (1944).

75.] Table II of Appendix B shows, for the pre-war, wartime and post-war periods, the food supplies per head per annum moving into civilian consumption in the United Kingdom. The figures are all national averages. They represent not what any particular individual eats but what, on average, the whole population is eating. Nor do they demonstrate any changes which may have taken place in the amounts of foods available to different classes or age groups within the population. Such changes as affect particular sections of the population are masked in the average figures. These averages are the only available data for the country as a whole and the only figures which enable a comparison to be made of the overall food position in different periods. The Ministry of Food has found them of considerable value in assessing the food supplies of the nation considered as a unit. They give no indication of the food consumption of any individual or group of people, nor of the manner in which supplies of food are distributed in relation to the differing physiological needs of different sections of the population.

76.] Changes in the consumption of individual foods are as follows:—

(i) *Dairy Products* (*milk and milk products, excluding butter*). The level of consumption of foods in this group reached 31 per cent above the pre-war level in 1943, and was slightly lower, at 30 per cent above, in 1945 and 1947. Liquid milk consumption stood at 44 per cent above the pre-war consumption in 1947. Cheese consumption, which rose to 59 per cent above the pre-war figure in 1942, has gradually declined since that year and in 1947 was only 5 per cent higher than the pre-war average.

(ii) *Meat* (*including canned meat and bacon*). This group reached its lowest point (23 per cent below the pre-war level) in 1941, but in 1947 was only 9 per cent below when calculated on carcase weight equivalent, or 15 per cent below when calculated on edible weight. There was greater variation as regards different types of meat, consumption of mutton and lamb being 10 per cent above the

pre-war consumption, and that of pig meat 83 per cent below. By the same year, consumption of canned corned meat had increased from the pre-war figure of 2·1 lb. per head per annum to 9·3 lb., and of other canned meat from 0·8 lb. per head per annum to 8·2 lb.; that is, an increase respectively of 4½ times and 10 times the pre-war figure.

(iii) *Fish, Poultry and Game.* An outstanding feature is the increase in the consumption of fish by 1946–7 to 28 per cent above the pre-war level, although that of fish, poultry and game fell at the beginning of the war to 61 per cent of the pre-war consumption.

(iv) *Eggs.* Total egg consumption, including dried and liquid egg, was lowest in 1941 at 24 per cent below, and highest in 1945 at 7 per cent above the pre-war figure. By 1946–7, consumption had again declined to 14 per cent below the pre-war level owing to decreased imports of dried egg.

(v) *Fats* (*including butter*). The consumption of butter had fallen to 69 per cent below the pre-war level in the years 1942–4, whilst production of margarine was approximately double the pre-war average production between 1941 and 1945. Consumption of butter, margarine and cooking fats in 1946–7 was 26 per cent less than in the pre-war period and lower than in any previous year. Consumption of butter was 56 per cent, lard and cooking fat 22 per cent and other edible oils and fats 44 per cent below the pre-war consumption, while that of margarine was 70 per cent above.

(vi) *Sugar and Syrups* (*including sugar in composite foods*). Consumption of these foods fell to 35 per cent below the pre-war figure in the years 1941–3, but by 1946–7 had risen to 26 per cent below.

(vii) *All Fruit* (*including Tomatoes*). Consumption of these, taken together, fell to 58 per cent below the pre-war figure in 1941, but recovered to about 35 per cent below in 1944 and 1945, and improved further to 18 per cent below in 1947.

(viii) *Vegetables.* Consumption has been consistently above pre-war levels except in 1940. After increasing steadily to 18 per cent above pre-war levels in 1945, it fell to 8 per cent above in 1946–7.

(ix) *Potatoes.* Potatoes have been a main source of calories to replace the loss resulting from reduced supplies of other foods. Consumption reached 60 per cent above the pre-war level in 1944 and 67 per cent above in 1947.

(x) *Grain Products.* Consumption between 1941 and 1945 was from 17 per cent to 22 per cent higher than before the war. As a result of bread rationing in July, 1946, it fell to 10 per cent above the pre-war figure.

Wastage

77.] The calculations made to allow for wastage in the process of collection, manufacture and distribution depend on the stage of production or distribution at which the weights of food are recorded. In the case of home-produced meat, for example, no problem arises in dealing with animals

rejected as unfit for human consumption, since supplies are measured after animals have been graded. On the other hand, statistics of vegetable production are based on the estimates of crop acreage, and due allowances must be made for quantities fed to livestock or not harvested. Wastage also includes that part of the food supply which is discarded before reaching the retail stage; fish consumption, for example, is expressed in terms of wet fillet weight. Wastage should also cover losses in the course of distribution, but information on these is not complete. It does not, however, include foods fed to pigs or poultry other than the official allowances. Hence the figures will overstate the foods actually eaten by human beings, the degree of overstatement depending on the number of pigs and poultry kept. Wastage in the home is not allowed for at all. If methods of distribution have not changed greatly, the value of the figures for comparative purposes is not affected. If, as it seems reasonable to assume in the case of the United Kingdom, food losses between the point of production or import and the retail stage of distribution are now less than before the war, comparisons made between the present and the pre-war food consumption tend in effect to over-estimate the pre-war consumption figures relatively to those for the present time.

Validity of the National Average Consumption Figures

78.] The validity of the calculations depends primarily on the accuracy of the basic statistics of supplies and their utilization. Accurate data are available on food imports and, with the wartime and present food controls, the statistics of home-produced supplies moving into consumption are accurate for most commodities to within a small margin of error, the major exceptions being home-grown fruit and vegetables. The same method of calculation has been used for each period, though in order to minimize any errors due to stock changes, which for the pre-war period could not be accurately measured, the average of the years 1934–8 was taken. The margin of error is more or less constant and does not detract from the value of the results for purposes of comparison.

79.] Table III of Appendix B shows the supplies of calories and nutrients in the years 1940 to 1947 compared with estimated requirements and expressed as percentages of the pre-war (1934–8) averages, as calculated from the consumption level estimates. The figures in this table conceal important changes in the pattern of consumption which have taken place during the war. An indication of these changes is provided by the varying contributions of the main food groups to the total calorie intake of the population, as shown in the following table, reproduced from "Food Consumption Levels in the United Kingdom" (1947).

PERCENTAGE OF TOTAL CALORIE INTAKE DERIVED FROM CERTAIN GROUPS OF FOODS

	Pre-war	1945	1946	1946–7
Dairy Products (excl. butter)	9	11	11	11
Meat (incl. canned meat and bacon) ..	17	13	14	14
Oils and Fats (incl. butter)	17	14	14	13
Sugar and Syrups	15	11	12	13
Potatoes	4	7	7	7
Grain Products	30	37	35	34
All other Foods	8	7	7	8
Total ..	100	100	100	100

Calories and Nutrients

80.] The average intake of *calories* was lowest (93–4 per cent of the pre-war intake) in the first two years of the war and highest (100 per cent) in 1944. After that year it declined slightly and in 1946–7 stood at 97 per cent of the pre-war figure. Total supplies of *protein*, from 99 per cent of the pre-war figure in 1940, have shown a gradual increase to 112–3 per cent in 1945–7, falling, however, by 1 per cent in the last year. The gain has been made principally in vegetable protein, which stood at 128 per cent of the pre-war intake in 1945 and 119 per cent in 1946–7. The intake of animal protein, which had remained consistently below the pre-war level during the war years, falling to 84 per cent in 1941, has risen each year since 1943 until it reached 6 per cent above the pre-war level in 1946–7. There has been a marked decrease in the *fat* content of the diet, the decrease varying between 13 per cent (1941) and 5 per cent (1944) during the war. Since 1945, a further decrease has taken place to 15 per cent below the pre-war level in 1946–7. *Per capita* supplies of *carbohydrate* remained slightly below the pre-war level for most of the war, but since 1944 have been 1–3 per cent higher. The *mineral* content of the diet has shown a marked improvement since the beginning of the war. In 1943 *calcium* intake, mainly as a result of the inclusion of calcium in flour for bread-making, was 49 per cent above the pre-war level, and *iron* intake was 28 per cent above; by 1946–7 the corresponding figures were respectively 63 per cent and 43 per cent above.

81.] The average daily intake of *ascorbic acid*, after allowances have been made for losses in storage, distribution and cooking, has been calculated to be:—

Pre-war	1940	1941	1942	1943	1944	1945	1946
52	44	35	44	43	48	51	50
mg.	mg.	mg.	mg.	mg.	mg.	mg.	mg.

The intake of ascorbic acid thus fell substantially in 1941 compared with the pre-war intake, after which it increased to the pre-war level. Throughout the whole period, including the pre-war years, the intake was much below the U.S. National Research Council (1941) allowance, although much above that recommended in this Report. *Thiamine* intake, which, owing to the use of flour of higher percentage extraction for bread-making, in no year has been less than 110 per cent of the pre-war consumption (1940), reached 166 per cent in 1944, decreasing to 156 per cent in 1946–7. *Riboflavin* and *niacin* intakes were at their lowest levels in 1941 (99–98 per cent of the pre-war figures) and at their highest wartime levels in 1944 (130 per cent and 119 per cent respectively). In 1946–7 both were 126–7 per cent of the pre-war levels. The average intake of *vitamin A* for the whole population has not yet returned to the pre-war level; it has fluctuated between 89 per cent (1943) and 95 per cent (1942–4–6/7) over the eight years under review. The above figures, calculated from gross supplies, must be regarded as only approximate.

3. FAMILY FOOD SURVEYS

Methods of Inquiry

82.] Much misunderstanding has arisen and many wrong conclusions have been drawn from comparison of the results of family food surveys made at

different times. The technical aspects of such surveys are, therefore, discussed in some detail. The usual method of inquiry is for the data to be recorded in the homes by the housewives, with their co-operation throughout the survey period, which is generally a week. This may influence their behaviour during the survey period, with the possibility that the results obtained may not be entirely representative of customary habits. Evidence is, in fact, available of such changes. Nevertheless, investigators who have had much experience of family food surveys are generally of the opinion that the information obtained is representative, for the housewives are involved in much effort and difficulty if they wish to maintain substantial changes from their normal procedure throughout even the survey period.

83.] In family food surveys, food consumption data of two kinds may be collected. First, they may relate to all the foods purchased or eaten during the period of survey, generally a week, from which calculations of the nutritional adequacy of the diet are made; secondly, they may relate simply to individual foods, such as milk, or groups of foods such as dairy products. The collection and interpretation of family food data draw on many branches of science, including analytical chemistry for the compilation of food tables and the physiology of nutrition for the setting of standards of nutrient requirements. Some of these have developed rapidly during the past few years, thereby affecting various aspects of the technique of food surveys. Consequently, comparison of the results of surveys made by different observers at different times is often a matter of some complexity and difficulty, and should be made only with expert advice.

84.] In some surveys the data have been collected by reliable methods such as the weighing of all the foods used during the survey period; in others by rough and ready methods with the likelihood of large margins of error. The data may relate to the amount of food eaten or the amount purchased. The calculation of the nutrient values of the diets requires the use of tables of food composition, of which there are many, differently compiled; the values in the tables may not be the true values for the foods actually eaten. But it is the method of expressing the results of surveys which has occasioned the greatest confusion in their interpretation and comparison. Because of the differing composition of the population groups surveyed in regard to age, sex and occupation, straightforward averages of the food consumptions and nutrient intakes of the various groups studied are not valid for purposes of comparison. Moreover, in considering the results of surveys made at different times, comparison is valid only if the families studied in the various surveys are drawn from the same or similar groups. Otherwise they may differ in some respects, such as social standing, which affect food habits.

85.] The varied composition of population groups under examination in respect of age, sex and occupation can be compensated for by expressing, for each group, the nutrient intakes as percentages of nutrient requirements, these percentages being valid for comparison provided the methods of calculation are the same in all important respects. But there are a number of differing standards of nutrient requirements, such as those of the League of Nations (1936) and the U.S. National Research Council (1941, revised 1945 and 1948), and those presented in this Report.

86.] For vitamins, standards differ substantially; but for calories, proteins and minerals the differences are small. Some difficulty arises in regard to the

estimation of nutrient requirements for different types of work, particularly in respect of calories; first, in a food survey it is not always possible to obtain precise information on the type of work done by each member of each family studied, and secondly, even if a full description of the work is obtained, it is difficult in many cases to estimate the requirements of that work. Thus, the calorie requirement of a coal miner depends on the length of time at the coal face, on whether the coal is got by hand or machine, on the kind of conveyance for removing the coal, and the like; that of the farm worker will similarly be affected by a variety of factors, such as the number of hours worked, the kind of work done, and whether or not the processes are mechanized. The difficulties arising in the study of the diets of persons of specific occupations are indeed formidable, and a satisfactory technique for meeting them has not so far been evolved.

87.] The method of assessing the nutrient adequacy of the diet of a group of families by comparing the nutrient intakes with the nutrient requirements has replaced the expression of results on a "man-value" basis. For this, the Cathcart-Murray scale was generally used. This sets out the proportions which the calorie requirements of women and children represent of the calorie requirement of the adult man, which was taken to be 3,000 Calories per day. For example, a child aged 8 years had a man-value of 0·7 and an adult woman a man-value of 0·83. The total man-value of the group studied was calculated from the number of persons of different sex and age of which it was composed, and this total was divided into the total intake of each nutrient to give the nutrient intakes per man-value. On the other hand, the average intake per head is obtained by dividing the total intake of each nutrient by the *actual number* of persons in the group. In this calculation each person, irrespective of age or sex, counts as one unit. The average intake per man-value is, therefore, a different estimate from the average intake per head. Thus for the same group of 55 families in the West Riding of Yorkshire (County Council of the West Riding of Yorkshire, 1939) the average daily intake was 2,340 Calories per head and 3,050 Calories per man-value.

88.] While the use of the Cathcart-Murray "man-value" scale is broadly correct for calories, simply because it was based on the calorie requirements according to age and sex, its use in relation to other nutrients and to food consumption, food expenditure and income is wrong, because the proportionate requirements of other nutrients, according to age and sex, are not the same as for calories. Thus, whereas the calorie requirement of a child aged 5 years is only 0·64 of that of a sedentary man, according to the U.S. National Research Council's (1941) standards, the calcium requirement of the child is greater than that of the man in the proportion of 1·25 to 1·0. The proper procedure is to use a different "man-value" scale for each nutrient, according to the nutrient requirements for persons of different sex, age and occupation. The principle of the "man-value" scale is thus correct, but its use has in many cases been wrong.

89.] The complexities can be illustrated by the recent controversy as to whether or not the nation is worse fed after the war than were the unemployed before the war. The average daily calorie intake of the unemployed in the pre-war period was 2,850 per man-value in Newcastle-on-Tyne (City and County of Newcastle-on-Tyne, 1936); and 87 per cent of calorie requirements, according to the League of Nations (1936) standards, in the West

Riding of Yorkshire (County Council of the West Riding of Yorkshire, 1939). The above surveys were restricted to families with children. The National Food Survey, which included working-class families with and without children, shows that in certain months in 1944 the average calorie intake was 102 per cent of calorie requirements according to the 1941 standards of the U.S. National Research Council (Drummond, 1948). The food tables in general use before the war give somewhat higher calorie results than the more recent ones used to calculate the nutrients for the National Food Survey.* Any comparison of the data for the unemployed families with children before the war, with the data for working-class families with and without children during the war, is open to so many qualifications that it serves little real purpose.

Pre-War Family Food Surveys

90.] Most of the pre-war food surveys were small and restricted to particular groups of the population. To assess the pre-war diet, therefore, requires the piecing together of information from a number of sources. Fortunately, the results from the various surveys support each other in general so that the emergent picture is fairly clear. The results of the pre-war surveys showed the effect on the diet of such economic and social factors as income, employment and unemployment, and the number of children in the family. The Committee has studied the reports of surveys which had been made, and concluded that the data from some of them could make but little contribution to the picture of pre-war conditions. There were several excellent surveys, the results of which were presented on a man-value basis, and this caused difficulties in interpretation and comparison. It must be emphasized and appreciated that that was the recognized method of presentation at the time the surveys were made. The Committee has studied in much detail the data presented in "Food, Health and Income" (Orr, 1936) and in "The People's Food" (Crawford and Broadley, 1938).

91.] The data in "Food, Health and Income" were derived from 1,152 family budgets, collected mainly during the spring and early summer of the years 1932–5. They included "an undue proportion of families in the industrial north, of families with small incomes and relatively large numbers of dependants". The figures of food intakes given in Table IV below (taken from Appendix VI, Table II of "Food, Health and Income") were not obtained directly from the actual amounts of foods consumed by the families investigated, but were based on purchases adjusted by reference to independent estimates of the national food consumption. They are, in effect, a mixture of what are now termed "consumption level estimates" and family food budgets, classified on the basis of the latter into income categories.

92.] The Committee is of the opinion that while the data presented in Appendix VI, Table II of "Food, Health and Income" do not precisely represent the foods actually eaten at the various levels of income, they do, in fact, broadly show the pattern of food consumption. The nutrient intakes of the various income groups were calculated in the normal way from the food consumption data, but instead of being compared with the nutrient requirements of each particular group, calculated from the sex and age

* Based on Medical Research Council War Memorandum No. 14 (1945) and U.S. Department of Agriculture Miscellaneous Publication No. 572 (1945).

composition of that group, they were compared with the average *national* requirement. The procedure followed may well result in considerable errors in the assessments of the adequacy of the diets in the various income groups. Moreover, it affects to a different degree the estimates for the various groups and those for the various nutrients. Thus, the low income groups contain a much greater proportion of children than do the higher income groups, which will make the calorie requirement of the group less than the national average. The possibility of a greater proportion of heavy workers in the lower income groups may tend to offset this to some extent. The calcium requirements of the lower income groups will, on the other hand, be much greater than those of the higher income groups. Unfortunately, no data on the sex and age composition of the various groups studied are presented in "Food, Health and Income" from which the necessary adjustments in the calculations could be made.

93.] The survey reported in "The People's Food" was the largest family food survey made before the war, and covered all social classes in a number of urban areas considered to be broadly representative of economic conditions in the country at that time. The method of survey was to ask the housewife, with the help of the investigator, to complete at a single interview a questionnaire on the amounts and values of food purchased for the whole family in the previous week. The Committee considers that this method could not be expected to furnish accurate information, and consequently does not feel disposed to use the data presented in its review of the pre-war position. As in "Food, Health and Income", the nutrient intakes of the various income groups were compared with the average *national* requirements instead of the requirements calculated separately for each group. It is suggested in "The People's Food" that the data obtained on the consumption of nutrients do not differ widely from those presented in "Food, Health and Income", but in fact this is not so. Thus, the calorie intakes presented for the income group of under 10/- per head weekly was given as 2,003 in "The People's Food" and as 2,317 in "Food, Health and Income", corresponding figures for the "10/- to 15/- group" being 2,252 and 2,768, and so on. The Committee considered the possibility of using data calculated from those actually obtained from the 1,152 family budgets and presented in Appendix VI, Table I, of "Food, Health and Income", but unfortunately, the list of foods in that table is not complete, and in any case, no data are available on the age and sex composition of the groups to enable the correct calculation of requirements to be made with which to compare the intakes.

94.] The pre-war position can be described by a selection of illustrative data. The consumption of protective foods varied directly with changes in income, as is shown by Table IV, derived from "Food, Health and Income". Milk consumption was, according to all recognized standards, exceedingly low, and many inquiries in different parts of the country left no doubt as to its unequal distribution. The average consumption of liquid milk was about 2·8 pints per head weekly; among the poorest groups it was even lower. Thus in a distressed area in South Wales it was 1·7 pints weekly (Harry, 1935), and in the West Riding of Yorkshire (County Council of the West Riding of Yorkshire, 1939) (Table V) consumption fell from 2·9 pints weekly in families with one child to 1·4 pints in families with four or more children, these figures corresponding to 61 per cent and 24 per cent of requirements.

A survey in Leeds (Bransby, 1946b) showed (Table VI) that the pre-school child received a lower proportion of his milk requirements than did the school child. From a survey of egg consumption it is concluded that "egg consumption is primarily a matter of income" (Butler, undated).

95.] Differences in the consumption of foods among different social classes were reflected in differences in the nutritional adequacy of the diets. This is illustrated by Table VII, which shows for groups selected according to income, whether employed or unemployed, and according to the number of children in the family, the percentages that the nutrient intakes represent of nutrient requirements. Two points emerge clearly: first, that even among the well-to-do section of the community the calcium intake was low, owing to an insufficient consumption of milk; secondly, that in poorer families or families with several children, not only was the intake of protective nutrients extremely deficient, but also the intake of calories was insufficient—that is, those families did not have enough to eat. For example, families with incomes of under 8/- per head weekly were receiving only about 30 per cent of their calcium needs and 80–90 per cent of their calorie needs, and families with five or more children about one-third of their calcium needs and 94 per cent of their calorie needs.

96.] Further evidence on the prevalence of under-feeding comes from the pre-war inquiries into the extent of poverty among working-class families. In such surveys a family is deemed to be in poverty if the income is insufficient to meet the designated minimum expenditure on food, rent, clothes and other necessities. The food allowances included in the minimum budget are in no way pretentious or extravagant. A family living in poverty is not likely to obtain even the designated diet, especially as expenditure on food is flexible and suffers reduction before that on many other items of the family budget. A number of different poverty scales have been adopted by different workers. This affects the estimate of the proportion of the populations studied which is deemed to be in poverty. It also prevents comparison of the results for the different localities unless the poverty levels adopted are exactly the same. The percentage of the working-class population living in poverty was estimated from survey data to be approximately: London, 1929–30, 8 per cent ("New Survey of London Life and Labour", 1932); Liverpool, 1929, 13 per cent (Caradog Jones, 1934); Merseyside, 1929–30, 14 per cent (Caradog Jones, 1934); Southampton, 1931, 16 per cent (Ford, 1934); and York, 1936, 31 per cent (Rowntree, 1941).* These figures are quoted, not to compare the extent of poverty in the different localities, but simply to show the existence of poverty according to the definitions adopted. Poverty fell with special sèverity on children—thus in York in 1936, 43 per cent of the children under 14 years of working-class families belonged to families existing in poverty.

97.] Another approach to the problem is by way of a comparison between the amount of money which families actually spent on food and the amount required to enable them to purchase the standard diet established by the British Medical Association (1933). This comparison was made by Murray and Rutherford (1941) for 11,489 households in different parts of the country. The data, grouped according to the number of children in the household,

*These figures, calculated from data given in the publications mentioned, are taken from "Food, Health and Income" (Orr, 1936).

are shown in Table VIII. Of the total households, 16 per cent did not make the estimated minimum standard expenditure on food for a family of appropriate size and constitution. These households included about 21 per cent of the total persons and 39 per cent of all children included in the survey. As the number of children in the family increased, so, in a higher proportion of the families, persons and children, the expenditure on food fell below the prescribed minimum.

98.] It is difficult to estimate from the available data the proportion of the population who were underfed, in the sense that they were not getting enough to eat, as distinct from those receiving insufficient minerals and vitamins. Orr (1936) estimated that 10 per cent of the population belonged to families with incomes of less than 10/- per head per week, and another 20 per cent with incomes of 10/- to 15/- a head. It is probable that the great bulk of the former group and some of the latter were underfed. Further, it is reasonable to assume that those sections of the population living in poverty were not getting enough to eat. In a relatively prosperous town like York, 17·8 per cent of the total population were in poverty in 1936. A high proportion of the unemployed, of those in receipt of relief and of widows with families must have been insufficiently nourished, and the wages in many important industries and occupations were so low that an adequate and palatable diet could not be had.

Wartime and Post-War Family Food Surveys

99.] Discussion of wartime and post-war family food surveys centres in the main round the National Food Survey. A few other surveys have been made, the largest being that of 849 working-class families with children in 1941 (Bransby, 1946a). This survey, in which an attempt was made to re-survey the families studied in the Carnegie and West Riding surveys before the war, showed that a large proportion of the families studied were underfed.

100.] Since 1941 until the present time, the Ministry of Food, at first in co-operation with the Ministry of Health, have carried out a large-scale investigation, termed the National Food Survey. With but small gaps, representative samples of urban working-class families have continuously been studied at the rate of 600–700 families a month; that is, about 7,000–8,000 a year. In addition, a few special surveys of other groups, such as middle-class families in the towns and families in rural areas, have been made from time to time, the data for these special groups being kept separate from those for the main sample. At first, only families in large towns were studied, but in 1942 the sample was extended to include a number of smaller towns. This change may affect the comparability of the results in the periods before and after it was made, although the error is likely to be slight. Working-class wards were chosen from each locality, and from these the households to be investigated were pre-selected on a random basis. Although every effort has been made to get representative samples, the samples actually obtained, because of practical difficulties, have tended to be slightly overweighted with families with small children. For this reason, the intakes of the samples are some 50–100 calories per day less than they would have been had the correct weighting been obtained.

101.] The method of inquiry, which was developed for the survey, has proved satisfactory in practice. The informants record the exact amount

and cost of all the foods obtained and, should they so wish, are provided with a spring balance. The investigator visits the housewife at least four times during the survey period of a week, and checks the information to ensure that all the foods eaten in the home, together with snacks and packed meals taken from home, are properly recorded. For this purpose, an ingenious series of checks has been devised. Up to the middle of 1942, the information collected related only to the foods purchased or obtained free, but subsequently it related to the amounts of foods consumed. The change was brought about by weighing food stocks at the beginning and end of the inquiry and by making allowances for the changes in stocks. Analysis of the data collected by the National Food Survey showed that in 1943 the purchased foods provided about 3 per cent less calories than did the foods actually consumed, the corresponding figure for 1944 and 1945 being 5 per cent. Since 1942 the average food consumption given in the results from the Survey refers to the amounts eaten at home, including snacks and the like taken from home, thus excluding meals purchased and eaten outside the home, such as those in restaurant and school and works canteen. The actual food consumptions and nutrient intakes were, in consequence, somewhat greater than those reported from the Survey.

102.] In the main, the Survey data have been presented monthly in the form of averages for working-class families without further subdivision, the Ministry of Food stating that, broadly, this treatment has been adequate for their administrative purposes. Up to about the end of 1943, the data were analysed to a limited extent to show the food and nutrient intakes of various groups within the population.

The Consumption of Individual Foods and Food Groups, as determined from Survey Data in the War and Post-War Periods

103.] The average consumption per head per week of each of the main foods for the years 1942–7 is given in Table IX. The year 1941 is excluded as the data for that year relate to purchases and not consumptions.

(i) *Milk.* The consumption of liquid milk by working-class families increased from 3·5 pints to 4·1 pints per head per week between 1942 and 1945. It declined to barely 4 pints in 1946–7. Condensed and dried milk together added approximately 0·3 equiv. pints in 1942 and 1945, and 0·4 in the years 1943–4 and 1946–7.

(ii) *Eggs.* There has been a steady improvement in the consumption of shell eggs, and the number per head doubled between 1943 and 1947. Total egg consumption declined, however, from 3 per head weekly in 1945 to 2·3 in 1947, owing to diminishing supplies of dried egg.

(iii) *Cheese.* The survey showed a steady decline in working-class consumption from 3·6 oz. per head weekly in 1942 to 2·3 oz. in 1947.

(iv) *Fats* (*butter, margarine and cooking fats*). Although consumption was well maintained at 8·6–9·2 oz. per head per week during the war, there was a decline after 1945 to a low point of 7·9 oz. in 1947.

(v) *Meat.* This group includes rationed and unrationed meat and meat products such as sausages. Total consumption of meats remained fairly steady at about 26 to 27 oz. per head up to 1947, when the reduction in the bacon ration caused a decrease of about an ounce.

(vi) *Fish.* The consumption of fresh fish rose from 4·9 oz. per head weekly in 1942 to 8 oz. in 1946. There was a decrease to 7 oz. in 1947.

(vii) *Potatoes.* Consumption fluctuated between 68·5 oz. per head per week in 1942 and 73·8 oz. in 1946. It declined to 70·8 oz. in 1947.

(viii) *Vegetables.* Total vegetable consumption (excluding potatoes) increased from 31·4 oz. per head weekly in 1942 to a maximum of 37·3 oz. in 1944. It fell in 1947 to 30·8 oz.

(ix) *Fruit.* Consumption of all fruits rose more or less continuously from 12·3 oz. per head weekly in 1942 to 15·7 oz. in 1946, then sharply to 21·7 oz. in 1947. The consumption of fresh fruit has run parallel to this trend, at about 2·3 oz. per head lower.

(x) *Cereals.* The average consumption of cereals of all kinds has varied between 81·2 oz. per head weekly in 1943 and 85·4 oz. in 1945. That of bread and flour, not including cakes and flour confectionery, has remained between 66 and 68 oz. per head, the averages for 1946 and 1945 respectively.

Calories and Nutrients

104. The average daily nutrient intakes per head for each of the years 1941–7 are given in Table X.

(i) *Calories.* The most significant feature of the figures is their constancy. The daily average intake per head in any quarter-year has been between 2,260 and 2,460 throughout the whole period of the Survey. In 1943, the average did not exceed 2,300 in any quarter-year, whereas from the first quarter of 1944 to the first quarter of 1945 consumption remained at or above 2,400 Calories daily. Since then, and up to the fourth quarter of 1947, the figure has varied between 2,350 and 2,260, following changes in the general availability of food.

(ii) *Protein.* Consumption of both total protein and animal protein has shown a general tendency to increase. Whereas in 1943 total consumption was 73–74 g. per head daily, by 1945 it had reached 75–77 g. and by the following year 76–78 g., this average being maintained in 1947. The amount of animal protein has increased steadily from 29–31 g. in 1941 to 36–37 g. in 1946 and 1947. Since 1943 approximately 47 per cent of the total protein consumed has been derived from animal foods. This gradual improvement was due partly to increase in the consumption of milk and meat, but principally to the larger supplies of fish.

(iii) *Fat* (from all sources). After increasing from 86 g. per head daily in 1943 to over 90 g. in 1944 and 1945, the average consumption of fat fell again to 86 g. in 1946, and in the following year declined still further to 82 g. daily.

(iv) *Calcium.* The marked increase in calcium intake, from about 600 mg. per head daily in 1941 to 855 mg. in 1943, was partly due to the fortification of flour with calcium carbonate, introduced in 1942, and partly to the rising consumption of milk. This level remained fairly constant until the latter half of 1946, when the extraction rate

of flour was further increased and the fortification with calcium carbonate raised from 7 oz. to 14 oz. per 280 lb. sack. The effect of this addition was shown by an average calcium intake of 996 mg. per head daily in 1947.

(v) *Iron.* The average consumption of iron by working-class families has increased from 12·4 mg. daily in 1941 to 14·3 in 1947, but the amount has fluctuated rather widely from month to month. Major factors influencing this nutrient figure have been the changes which have taken place in the extraction rate of flour and changes in the supplies of meat and potatoes. The iron content of flour has varied between 1·4 and 2·8 mg. per 100 g.

(vi) *Vitamin A.* The average intake has remained remarkably constant during the period of the survey. The fluctuations from year to year have all been within 6 per cent of the seven-yearly average of 3,090 i.u. (as pre-formed vitamin A).

(vii) *Vitamin B Complex.* Bread and flour have been the major contributors of thiamine, riboflavin and niacin throughout the survey years, and this fact explains the similarity in the fluctuations of the intake averages. Low figures for 1945 and early 1946 were due to the reduction in the milling extraction rate from 85 per cent to 80 per cent of the grain, and a peak towards the end of 1946 can be attributed to the temporary increase in the extraction rate from 85 per cent to 90 per cent. The latter change had a marked effect on the consumption of niacin since it caused the niacin content of flour to increase from 1·7 to 3·6 mg. per 100 g. Other foods have, of course, supplied substantial amounts of the B vitamins, and a high average intake in the summer of 1944 was mainly due to an increased consumption of meat and milk.

(viii) *Ascorbic Acid.* The average intakes, after allowance has been made for losses in storage, distribution and cooking, were estimated as follows:—

1943	1944	1945	1946	1947
39	40	41	45	44
mg.	mg.	mg.	mg.	mg.

Nutritional Adequacy of the Diets

105.] The nutritional adequacy of the diets of the families studied in the National Food Survey can best be assessed by comparing the nutrient intakes with the estimated nutrient requirements, after the necessary adjustments, such as those for meals eaten outside the house, have been made. The Ministry of Food, although providing their data on nutrient intakes for the use of the Committee, were not in a position to provide a comparison with requirements because they have not yet decided on the most satisfactory method of allowing for outside meals. Reasonable estimates of the adequacy of the diets can, however, be made, except for calories, in two ways. First, the intakes found in the National Food Survey can be considered in relation to the nutrient requirements of the whole of the population of the United Kingdom. In 1946, these requirements were, per head daily, as calculated from the U.S. National Research Council (1941) recommended allowances: calories 2,550; protein 63 g.; calcium 900 mg.; iron 12 mg.; vitamin A.

2,580 (as preformed vitamin A); thiamine 1·3 mg.; riboflavin 1·7 mg.; niacin 13 mg.; and ascorbic acid 70 mg. (Cmd. 7203, 1947). The average requirements are not likely to be much different in any of the years 1941–7. Comparison of the average intakes actually found with the average requirements of the whole population will give a good idea of the adequacy of the diets, except for calories, this exception being due to the overweighting of the National Food Survey with families with children, which thus reduces the calorie requirement of the sample studied compared with the national average. The intakes of protein, iron and vitamin A were greater than the above recommended allowances in each of the years 1941–7, and those of calcium were considerably below in the earlier years and above in the later years. The intakes of the B vitamins tended to be below the allowances in the earlier years, and about or over the allowances in later years. The intakes of ascorbic acid were about 40–45 mg. per head daily. It must be remembered that the intakes in Table X do not include the nutrients provided by meals obtained outside the home, which would, of course, improve the picture.

106.] The calorie position is difficult to assess, because requirements are set somewhat precisely and a small deficiency, say, of the order of 5–10 per cent of physiological needs would result in a loss of physical efficiency. Factors such as the overweighting of the sample with large numbers of families with children and the practice of eating meals outside the home are thus of consequence and, without the further necessary information, no assessment can be made as to whether or not sufficient calories were being obtained. It can, however, be noted that the calorie intakes have fluctuated from year to year, the highest intakes being in 1944 and 1945, and those in 1943 being about 5 per cent, and those in 1946 and 1947 about 3 per cent, below these levels. It is probable that the composition, and hence the requirement, of the sample of the population studied has not varied much from year to year; if this be so the calorie intakes reached their highest level in 1944 and 1945.

107.] A second way of assessing the adequacy of the diets is to use data presented by Drummond (1948). He published the nutrient intakes of the working-class and middle-class families studied in the National Food Survey in certain months in 1943, 1944 and 1945, together with the nutrient requirements of all the working- and middle-class families studied in 1944. The requirements of the working-class samples in 1944 can thus be compared directly with the intakes of working-class families in 1944 as given in Table X. It should be observed that this comparison is valid since the intakes exclude meals eaten outside the home, for which allowance has been made in assessing nutrient requirements. The intakes (Table XI) of calories, protein, calcium, iron, thiamine and niacin were found sufficient, that of riboflavin was slightly insufficient, while the actual intake of ascorbic acid was much below the standards adopted. A point of interest emerging from Table XI is the difference in the requirements of the samples studied and those of the whole population given in Table III.

The Consumption of Calories and Nutrients by Different Groups

108.] It has already been stated that up to about the end of 1943 some analyses of the data of the National Food Survey were made to show the food consumptions and nutrient intakes of various groups of the population.

In accordance with the pre-war custom, the families were grouped on the basis of "food expenditure per head", and the results for two periods, the end of 1941 and the end of 1943, were available to the Committee.

109.] Comparison of the data grouped according to food expenditure is complex for a number of reasons. Between 1941 and 1943, there were substantial changes both in food prices and in earnings; comparisons of food consumptions at the same levels of food expenditure in 1941 (Table XII) and 1943 (Table XIII) do not reflect the real changes which may have occurred. Comparison is further complicated by the changes in the treatment of the data between 1941 and 1943. Tables XII and XIII give the average consumptions of various foods in the two periods. Those for 1941 relate to "food consumption per diet head weekly", that is, with an adjustment made for meals eaten outside the home, and those for 1943 relate only to *consumption* in the home. Tables XII and XIII are presented simply and solely to compare the consumptions at the various levels of food expenditure *within* each period and not to compare the consumptions in one period with those in the other.

110.] In considering the data in Tables XVI and XVII an increase in average food consumption with increasing expenditure on food could in some degree be expected as the groups with higher food expenditure have higher ratios of adults to children, and hence a higher calorie need, than the lower food expenditure groups. What, however, is striking is that inequalities between the groups are not only found for "filling-up" foods such as cereals, but also for rationed and unrationed meat, fish, vegetables and fruit. Moreover, the consumption of milk, instead of falling with increasing food expenditure as it would if consumed according to nutritional needs, rises with increasing food expenditure. Both at the end of 1941 and at the end of 1943, the consumption of many of the nutritionally valuable and of the more palatable foods was still uneven among the different sections of the population, being greatest among those spending much on food and least among those spending little in the different sections of the urban population studied.

111.] The unpalatability of the diets of the lower expenditure groups is shown by the available information on the kinds of meals eaten at different expenditure levels (Table XV). Families who spent little on food had "bread and spread" about three times as often as did those who spent much, and their consumption of "cooked meals" was much less. There can thus be little doubt that the diet of the lower expenditure groups was even less varied than that of the people who spent more money on food, and these groups may well have reduced their calorie intakes below their requirements. That this may be so is supported by data on calorie intakes at different levels of food expenditure.

112.] Much caution is required in interpreting the assessments of the adequacy of dietary levels from data classified according to food expenditure. The object of any analysis of survey data for nutritional purposes is to attempt to find a criterion for grouping families, to examine the adequacy of food and nutrient consumptions of particular groups. The nutrient intakes depend on the foods eaten, which in turn depend substantially on the amount spent on food. In such an analysis it is, however, assumed that all individuals of a particular age, sex and occupation have the same calorie requirement, whereas actually there is a considerable variation in individual requirements.

The method of analysis will thus tend to exaggerate the numbers whose intakes fall below requirements and also those whose intakes are markedly above requirements. It is clear that there will be a tendency for those whose requirements are higher to fall into higher expenditure groups.

113.] Table XIV sets out the percentages that the calorie intakes represent of requirements in 1941 and 1943, the figures for 1941 having been adjusted to make them relate to consumption and not to purchases. The figures in Table XIV show that 20 per cent of the families studied at the ends of 1941 and 1943 received less than 95 per cent of their calorie requirements. For the reasons stated the proportion receiving insufficient calories is likely to be exaggerated by the method of analysis, but Table XIV does support the inference from Tables XVI and XVII that the diet of the lower expenditure groups may have been so unappetizing as to result in an insufficient calorie intake. Had the calorie intakes of the low expenditure groups been due entirely to their below-average requirements, it is likely that the consumption of the more appetizing and expensive foods would have been more equal than in fact they were.

114.] Data are available also for 368 families surveyed both at the beginning and at the end of 1941. The families were grouped according to their food expenditure per head at the beginning of 1941, and in Tables XVI and XVII are shown the average consumptions of certain foods and the percentages that nutrient intakes represent of requirements of the *same families* at the beginning and end of 1941. By the end of 1941, the consumption of milk had become more even among the groups, although a slight disparity still existed, while the disparity in the consumption of potatoes and vegetables had increased, especially among the poorer classes. Table XVII demonstrates the general improvement in the dietary patterns of the poorer groups, although deficiencies still remained. As these data relate to only 368 families, they cannot be taken to apply to the whole of the working class, but simply to indicate a trend.

115.] The existence of a substantial amount of underfeeding in 1941 is not unexpected in view of the pre-war position and the fact that those features of the wartime system of food control which had such a powerful effect on the pattern of food consumption had not by then become fully established. Moreover, 1941 is generally considered to have been the worst year for supplies of food. The following extract from "Food Consumption Levels" (1944) is relevant: "In the United Kingdom there was a sharp fall in food supplies in 1940 and 1941 . . . at the period of greatest shortage, in the first half of 1941, calorie supplies fell to 2,680 and animal protein to 33 grammes per head per day." It is further stated: "At that time (e.g., early 1941) . . . although rationing was well established, there were indications of impaired health and working efficiency."

Comparison with the Pre-War Position

116.] The Committee recognizes that a major part of its task was to compare the levels of food consumption before and since 1939. To this end, it has examined the available information, but has to state that in its opinion a reliable comparison cannot be made. There are, in the literature, a few

pre-war data with which a limited comparison might be made, but the Committee considers that it would be profitless to do this, as the resulting picture would be too patchy to be of any value.

4. INDIVIDUAL FOOD SURVEYS

117.] In individual food surveys, records are obtained of the amounts of prepared foods eaten by an individual, there being no question of the partition of the foods among the various members of the family. As with family surveys, there are reliable methods of survey with a low margin of error, and rough and ready methods with the possibility of large errors, the value of the results depending on the methods used for collecting data. Calculations of the nutrients in the diets are subject to a double error—the composition of the foods eaten may differ from those given in the food tables used, and the composition of the made-up dishes may vary even more. The recipes used by housewives differ not only between individuals but also in specific localities, yet the recipes can seldom be taken into account in the food tables used to calculate the nutrients in the diets. But despite these difficulties, a number of investigations have shown that the results in terms of consumption of nutrients by groups of individuals, obtained by the more exact methods, are in good agreement with the actual values found by chemical analysis (Bransby *et al.*, 1948 ; Widdowson and McCance ,1943).

Pre-War, Wartime and Post-War Individual Surveys

118.] Few individual surveys have been made in the United Kingdom and, except in the survey of children's diets made before the war (Widdowson, 1947) and the survey of children's diets in 1943–4 (Bransby and Wagner, 1945), the number of subjects has been small. Surveys conducted before and since 1939 are listed in Table XVIII. Table XIX shows that in some groups the reduction in consumption of some foodstuffs which resulted from rationing was much more than the average reduction per head as shown in "Food Consumption Levels".

119.] The surveys of the diets of schoolboys and middle-class women made during the war are fully comparable with those made in the 1930's. The children of Widdowson's 1935--9 survey (1947) included 35 per cent of children of professional and 51 per cent of "upper working" class and the majority lived in S. England, while the children surveyed during the war lived in Midland towns (Bransby and Wagner, 1945) and in Scotland (Roscoe and McKay, 1946) and were working-class. It might also be expected that the lactating and pregnant women surveyed during and after the war would have eaten more than the pregnant woman of the pre-war survey of McCance, Widdowson and Verdon-Roe (1938), as the latter were in the main from homes in poor circumstances. In all surveys which are reported in such a way that comparisons are possible—and here it must be repeated that but few surveys have been made and that most of these were restricted to children and expectant mothers—the amount of *meat* and *sugar* eaten during the war was less than before and the amount of *bread* considerably greater. The amount of *potatoes* was greater in all except one of the schools surveyed by Widdowson (1947). Amounts of *fruit* eaten were less during the war, except in the industrial towns in the autumn of 1943 when fruit was plentiful

(Bransby and Wagner, 1945). The amount of *vegetables* eaten by children in the pre-war survey was less than the amount eaten by children in industrial towns in 1943-4, but about the same as eaten in Edinburgh in 1945; however, the pre-war amounts in Edinburgh may have been less than they were further south.

120.] The amount of *milk* drunk by children in the industrial towns (Bransby and Wagner, 1945) and in Edinburgh (Roscoe and McKay, 1946) during the war was about the same as that drunk by relatively well situated children in Widdowson's 1935-9 survey (1947). As the classes and localities differed, the children in the industrial towns may have drunk less milk before the war than the children of Widdowson's survey. It cannot be inferred from the surveys that the consumption in the industrial towns had not increased. In two schools (Widdowson and McCance, 1942) the boys were getting more milk than before the war; in the third the boys were not taking milk under the milk-in-schools scheme and consumption in 1942 was less than before the war.

121.] Among the women studied in Shoreditch by the Social Survey, 57 per cent took over 19 oz. of liquid milk daily, while the average amount consumed before the war by the richest group of pregnant women was only 16·4 oz. and in the three poorest groups average consumption of all milk was equivalent to less than 10 oz. of liquid milk (McCance, Widdowson and Verdon-Roe, 1938). But in Edinburgh (Roscoe and McKay, 1946) only 4 out of 35 pregnant women drank a pint of milk a day, and the average was only 11·4 oz. a day. Only 15 of these 35 women were taking orange juice and only 23 taking cod-liver oil. In Bristol about two-thirds of the pregnant women were getting 14 or more oz. of milk a day, and the average amount consumed was 17·6 oz. a day. However, 80 per cent were not taking their full allowance (Hobson, 1948). In London (Obermer, 1948) 40 per cent of women in the first half of pregnancy and 52 per cent in the second half were taking a pint or more of milk per day; only 6 per cent and 3 per cent in the two groups were taking under 300 ml. (10·5 oz.).

Calories and Nutrients

122.] The results of these changes in the consumption of foodstffs were as follows:—

(i) *Calories*. In all the wartime and post-war surveys, the average number of calories consumed daily was little different from the number consumed by persons of the same age and sex before the war.

(ii) *Total protein* was little changed.

(iii) *Animal protein* was less during and after the war except among pregnant and nursing women. The average found by the Social Survey in Shoreditch was more than that consumed by the richest two groups in the pre-war survey of pregnant women (McCance, Widdowson and Verdon-Roe, 1938). The consumption by children fell by 10 to 20 per cent and by adults (other than pregnant and nursing women) by 17 to 40 per cent. The average amounts of animal protein eaten by pregnant women in Edinburgh (Roscoe and McKay, 1946) and Bristol (Hobson, 1948) during the war were higher than the averages eaten by all but the two richest groups in the pre-war survey.

(iv) *Fat.* Consumption by children and pregnant and nursing women was little affected. Consumption by older schoolboys and adults fell by 10 to 20 per cent.

(v) *Calcium.* The consumption by children in industrial towns was on the whole higher than in the pre-war survey, but in only one age period was the difference over 0·15 g. a day. Among schoolboys and adults consumption rose. Among nursing women after 1942, and pregnant women in Edinburgh in 1947, consumption was higher than in the richest groups of pregnant women before the war.

(vi) *Ascorbic Acid* intake, on the whole, fell considerably. However, average intakes remained at a fairly satisfactory level—over 20 and often over 30 mg. a day. Pregnant women in Bristol took an average of 81 mg. a day (cooking losses allowed for). Only 18 per cent took under 50 mg. a day and the minimum was 20 mg.; 78 per cent had some vitamin supplement.

(vii) *Vitamin A.* The amount consumed by children in industrial towns (Bransby and Wagner, 1945) was slightly less than found by Widdowson (1947) before the war, but, if vitamin A from liver is excluded, considerably more. In 1942 schoolboys got less, both as preformed vitamin A and as carotene, than before the war. Students in Edinburgh got about 10,000 units a day (Kitchin, Passmore, Pyke and Warnock, 1949). Seven out of 34 university students in London in October 1946–7 took under 2,500 i.u. a day; 9 out of 52 showed a significant improvement of dark adaptation after receiving supplements of vitamin A. Of the 13 students for whom both measurements of dark adaptation and food intakes were made, only the 3 whose diets contained less than 2,500 i.u. daily showed an improvement of dark adaptation due to the vitamin supplements (Doraiswami and Yudkin, 1948). Eighty-four per cent of the pregnant women in Bristol (Hobson, 1948) were taking the officially provided vitamin supplements; the average intakes of vitamins A and D were therefore 7,600 and 800 i.u. a day respectively.

Conclusion

123.] These surveys indicate that people in the groups studied could and did get enough calories during the war years. Judged by the League of Nations standards, the average consumptions of calories and proteins were adequate. This involved a change in food habits, and the survey of the diets of middle-class women (Widdowson and Alington, 1941) shows that this adaptation had been made by the spring of 1941. The main changes in nutrients supplied were those that might be expected—increase in consumption of cereals and potatoes, and reduction in that of animal protein, fats and vitamin C. The fall in animal protein was probably of little nutritional significance but reduced the palatability of the diets. There is also a possibility that there was an insufficient intake of vitamin A. The diets of pregnant women of the working classes had improved since the pre-war years, but these women did not make full use of their allowances of milk and meat.

124.] The survey of the diets of middle-class schoolboys (Widdowson and McCance, 1942) illustrated two points: (1) in 1942 some were not making

full use of the foodstuffs provided by rations—milk, cheese, meat and bacon; (2) boys living at home got more than their share of rations of meat and bacon.

125.] The fact that the amount of milk drunk by working-class children in industrial towns in 1943–4 (Bransby and Wagner, 1945) and in Edinburgh in 1944-5 (Roscoe and McKay, 1946) was as high as in the survey of 1935-9 (Widdowson, 1947), which included a considerable proportion of wealthier classes and dealt mainly with the South of England, suggests that by 1943 the consumption of milk depended less than formerly on locality and income. The chief deficiency before the war, however, was that of calcium. In the survey in industrial towns 57 per cent to 63 per cent of the children got enough calcium according to the standards of the League of Nations.

126.] The principal evidence of the relation of diet to income during the war years is found in the survey of the diets of children in industrial towns in 1943–4. According to this survey the diet improved with increasing expenditure on food; but there was, on the average, little change with changes in the size of the family, except that the larger the family the smaller was the intake of vitamin A and ascorbic acid, and that in big families the proportion getting adequate calcium was less.

127.] The Committee wishes to comment on the paucity of individual survey data available, a paucity which is surprising in view of the valuable information which such data could provide.

5. CALCULATION FROM AMOUNTS OF RATIONED AND UNRATIONED FOODSTUFFS

128.] The numbers of calories that might be consumed by individuals or families in various groups have been calculated from the known allowances of controlled foodstuffs and estimates of the amounts of uncontrolled foods that might be eaten. Examples are given in Table XXV. It must, however, be emphasized that estimates of this kind can serve only as broad indications of the amounts of food available to different sections of the population. Moreover, estimates which include the allowances of bread under the bread rationing scheme are to some extent unreal owing to the laxity of bread rationing.

129.] The reason why the estimate of the number of calories obtainable from controlled foods made by Bransby and Magee (1947) is higher than the other estimates, is that they aimed to show how certain individuals might make up their requirements with the foodstuffs that they might get to prevent their going hungry, without regard to the usual pattern of expenditure. Thus they allowed an adult 24 oz. of potatoes a day. This is about twice the average amount which went into consumption according to "Food Consumption Levels". Taking the usual calorie value of pointed foods and allowing 10 oz. of potatoes a day and other foodstuffs according to the estimate of Bransby and Magee (1947), a single normal adult could get only 1,870 Calories apart from meals outside the home. The calories obtainable by a family consisting of a manual worker, wife and two children aged 12 and 6 years are given in Table XXVI.

130.] The average intake per head in September, 1947, according to the National Food Survey, which does not include personal points (sweets), was 2,220 Calories. When personal points are taken into account the difference between the National Food Survey average (2,300 Calories) and the estimate of Table XXVI (2,134 Calories) is 166 Calories. However, the amounts of controlled foods found in the National Food Survey exceeded the rations by a difference that would account for about 100 Calories per head per day. The remaining difference of 60 Calories may well be due to difference in composition of the family considered from that of the average family of the survey.

131.] Bransby and Magee (1947) pointed out that the rations of children under 5 years old supplied more calories than are needed; children of from 5 to 10 years get about as much as they need from rationed foods alone. But adolescents, normal adult males, pregnant women and manual workers, with higher calorie requirements, would have real difficulty in getting enough (even with the high estimate of the possible calorie value of pointed foods) unless they got meals in canteens or restaurants or ate prodigious quantities of potatoes—about twice the average amount going into consumption. Families with young children can make up some of the deficit by drawing on the surplus calories of the rations of children under 5 years. According to the standards of the League of Nations, the family in Table XXVI would need some 2,480 Calories per head per day; requirements according to other standards differ but little. Without extra food the family is short by 350 Calories per head daily. If father and children have dinners in canteen and school they can make up this deficit. On the other hand, a single adult male who was not a manual worker would not get enough to eat unless he took more than one meal outside.

132.] Bransby and Magee (unpublished observation, 1948) found that the difficulty in getting enough calories became even greater when rations were further reduced at the end of 1947, and rationing of potatoes reduced the calories obtainable by over 50 Calories per head.

133.] Another method of assessment of the sufficiency of the foods available was that used in a series of studies from 1941 to 1948 in Oxford to provide a gauge of the changes in the cost of a "human needs" diet of a "standard" family, consisting of a man, wife, a child aged 5 years and two children aged between 7 and 12 years. The purpose of these studies was not only to measure the changes in cost of such a diet, but also to ascertain whether a nutritionally satisfactory diet could, in fact, be obtained, taking account of rationing and other prevailing controls and the foods actually available in the shops. These studies were entirely practical and took account of the shopping problems with which housewives were faced. Thirteen surveys were made between March, 1941, and Spring, 1948.

134.] Throughout the war the "housewife" of the "standard" family would have had little difficulty in obtaining the "human needs" diet, the cost of which for the family of five increased from 33/- in March, 1941, to 36/1½ in April, 1945. In regard to the survey made in the Spring of 1945, however, it was stated that although the diet could be purchased without any difficulty, "only a housewife who was a moderately skilled cook and also had a fair knowledge of nutritional values and requirements would have been able to provide a satisfactory diet for her family at the cost stated." The picture

changed somewhat in Spring, 1946, for although the diet could still be obtained without much difficulty, it is suggested that the shortage of fats made it difficult for adults to obtain a sufficient calorie intake without considerable strain on the digestion, this being the cause of the "recurrent complaints" that "people have not enough to eat". The same point is made in regard to the survey in Spring, 1947. At that time cheap fish, meat and vegetables were scarce and bread and flour were rationed, but two fairly inexpensive calorie foods, oatmeal and barley flakes, could be bought freely. "It was therefore possible for a housewife to obtain enough food to prevent her family from going hungry, although sometimes it may have been difficult to induce everyone to eat his full share of the meals she was able to prepare with the foods that were available." Potatoes and bread were both rationed at the time of the survey in Spring, 1948, but it was possible to make good the shortages by other foods. The view was expressed, however, that the "various important changes in rationing necessitated a large number of adjustments in the planning of the family diet that were difficult to make, in particular when they had to be procured at the lowest possible cost".

135.] These surveys suggest that after the end of the war the difficulties facing housewives in obtaining a sufficient and appetizing diet for their families were increased, owing not so much to an actual shortage of food as to an insufficiency of the more palatable foods. Those especially affected were families who could not afford to spend much on food and those groups of the population, such as adults, who had high calorie needs (Schulz, 1945–6–7–8).

136.] Materials used for the manufacture of alcoholic drinks are not included in "Food Consumption Levels", nor are alcoholic drinks included in the National Food Survey. The 1,192 and 1,097 million gallons of beer drunk in 1946 and 1947 would supply about 80 Calories per head per day and appreciable amounts of riboflavin and niacin. This source of calories and vitamins is not evenly distributed.

137.] Consideration of the differences between the assessments by different methods brings out the chances of inequalities of consumption which are not due to inequalities of income. The supply of unrationed foods such as sausages, meat pies and fish varies in different localities. The opportunity to buy these foods and to get outside meals varies from person to person. A woman working away from home may be able to get some 900 Calories a day as a canteen meal and snacks, while a woman working at home may have difficulty in getting more than her bare rations.

6. THE SYSTEM OF FOOD CONTROL

138.] The most important features of the system of food control fall into two groups: those which affect the availability of the foods and nutrient supplies of the whole nation, such as rationing, food price control, the raising of the rate of extraction of flour, the addition of calcium to bread, and the fortification of margarine with vitamins; and those which are directed to improving the food intakes of certain classes of the population according to their special nutritional needs. Among the latter are the control and

distribution of milk, the extension of communal feeding, the vitamin schemes and the special food allowances to expectant mothers.

Milk

139.] The distribution of milk has been controlled both during and since the war and the welfare schemes which existed before the war have been enlarged. The schemes have been based on the principle that, within the limits of the available supplies, milk should be distributed according to physiological need. Under the national milk scheme introduced in 1940, expectant mothers and children up to the age of 5 years are entitled to 1 pint of milk daily at a reduced price, and necessitous cases are supplied free of charge. Mothers with babies under one year of age have a priority allowance of 1 pint daily at full price, additional to the allowance to the child. Before the war $2\frac{1}{2}$ million children, or about 55 per cent of the total, were taking milk at school, of whom 560,000 received it free. By October, 1945, the proportion had increased to about 72 per cent. In 1946 milk in school formed part of the Government's system of family allowances, and as a consequence was provided free. The latest available returns—those for June, 1948—show that 92 per cent of school children were then receiving milk in school. Under the system of other milk priorities, children between school age and 18 years are permitted an extra $\frac{1}{2}$ pint of milk daily at home at full price. The rest of the population share whatever milk is left after the priority needs have been met, this amount falling to about 2 pints a head weekly in late autumn and winter.

140.] The total milk sold as liquid milk off the farm increased between 1939 and 1946 by 50 per cent. This increase far outweighs the reduction in consumption of evaporated, condensed and dried milk, which added about 22 per cent to the total milk equivalent consumed in 1939. In 1946 the amounts of these prepared milks had been reduced by only about one-third, the change being from condensed skim to evaporated full cream and dried skim milk. In 1947 milk supplied under the national milk scheme made up 15·6 per cent of total consumption of liquid milk; school milk made up only 3·4 per cent. Milk sold outside these schemes, for children over 5 and "normal" adults, rose between 1939 and 1946 by 28 per cent.

141.] Evidence of the effect of the milk distribution and welfare schemes comes from a number of sources. Whereas before the war only about 2 million gallons of milk were consumed monthly under welfare schemes, in 1947 20 million gallons were so consumed (Table XX). A survey made by the Milk Marketing Board on the consumption of milk in various towns in November, 1935, and November, 1944 (Table XXI), showed how the pre-war unevenness in milk consumption was being levelled. The greatest increase was in Gateshead, Seaham and Wallsend, localities which before the war had experienced much industrial depression; on the other hand, consumption failed to increase in only 3 towns, Harrogate, Southport and Salisbury, which are non-industrial and were well-to-do before the war. Kon (1945) presented data obtained from the Ministries of Food and Health on the changes in milk consumption between 1941 and 1943 among families grouped according to their expenditure on food. These leave no doubt that within that period milk consumption increased substantially among those families spending little on food, thus making consumption more equal in all sections

of the population (Table XXII). The effect of the national milk scheme and the milk in schools scheme in levelling the milk consumption of the poorer families is shown by the figures given in Table XXIII. There can thus be little doubt that, at least up to 1944, the milk consumption of the poorer sections of the population increased considerably and that distribution was much more in accord with need than in the pre-war period. Whether all the milk intended for particular sections of the community has, in fact, been drunk by them, is another matter. In regard to milk provided to the home, Schulz (1947) says that " . . . the inevitable conclusion . . . is that by a number of families the milk obtained under the Government schemes for infants is treated as ordinary milk and is used partly for other members of the family".

Communal Feeding

142. The purpose of the extension of communal feeding during the war was to meet the food needs of children and of workers in heavy industry and to make relatively cheap meals "outside the ration" available to the population in general. There was thus a great increase in the number of meals served in schools and works canteens, and in the establishment of British Restaurants, together with special schemes, though on a somewhat restricted scale, for the feeding of farm workers. The speed at which these advanced is shown in Table XXIV, reproduced from the official publication, "How Britain was Fed in Wartime". By 1947 the total number of main meals and minor meals served in civil and Service canteens, hotels, cafes, clubs and catering establishments "outside the ration" in Great Britain was about 26 million daily. The scale of food allowances to works canteens varied according to the kind of work done, being greater for workers in heavy industries than for others.

143. In 1938, the last full year of peace, some 160,000 elementary school children (3·9 per cent of the total) were taking dinners at school; of these 110,000 received them free. By June, 1948, dinners were being provided for over 2½ million children daily, or about 50 per cent of the total children. Together with the increase in numbers receiving dinners, there has been a marked improvement in the quality of the meals served compared with the pre-war period. Also important is the changed outlook on the school dinner; before the war it was considered a sign of poverty, whereas now it is an accepted part of the school routine.

Vitamin Schemes

144. Early in the war, distribution of cod-liver oil and fruit juices for young children was begun, the scheme with various modifications being extended later to older children and expectant mothers. The uptake of these vitamin supplements was, however, disappointing, the percentage uptake in England for fruit juices reaching about 46 per cent; from July, 1946, cod-liver oil and vitamin A and D tablets were issued free, the uptake subsequently increasing in the last quarter of that year to 34 per cent and 49 per cent respectively.

Allowances to Special Groups

145. In addition to the ordinary rations, additional allowances of various foods have been made to groups of people with special needs. These include

expectant mothers, children, adolescents, invalids at home, hospitals and institutions, convalescent homes and special industrial groups. For example during the war a scheme was started for the provision to adolescents of national milk cocoa ("Namco"), a special drink made from dried skim milk powder and cocoa. This scheme did not prove popular.

7. DISCUSSION

146.] From the various kinds of information discussed in the previous paragraphs, a picture can be obtained of the diet of the nation and the way in which it changed during and since the war. The information is of two kinds: direct statistical data from consumption level inquiries and food surveys, and indirect evidence from the nature of the food control system in general and its component parts such as rationing and welfare schemes. The technique of consumption level inquiries has been developed largely since the beginning of the war and such inquiries, which have been made annually during the past few years, have become an instrument of importance and precision in assessing the food supplies of the nation. The disadvantage is that they relate to the amounts of foods entering the shops or at some similar stage of the distributive process and not to the foods actually eaten, the difference between the two being affected by changes in distribution losses and wastage; but despite this discrepancy they provide reliable information, obtainable in no other way, on the levels of, and changes in, the nation's supplies of food and nutrients.

147.] The consumption level studies demonstrate some remarkable features of wartime and post-war food supplies. Among the former must be reckoned the noteworthy increase in the supply of milk; among the latter are the 7 per cent increase in egg supplies in 1945 compared with the pre-war period, and the high proportions of the pre-war egg supply, 86–87 per cent, available in 1946 and 1947. The supplies of meat in 1946 and 1947, 82 per cent and 85 per cent of pre-war edible weights, are higher than is generally supposed. The increase in vegetable supplies, a maximum of 18 per cent above the pre-war level in any post-war year, seems small in view of the intense propaganda to increase consumption. The figures, however, probably fail to take account of the increase in home-produced vegetables; on the other hand, the small degree of increase may well be due to a shortage of supplies in the shops, to high prices, or to a combination of both. The figures presented year by year from 1940 to 1947 leave no doubt that the nature of the national diet has undergone a substantial change, illustrated, for example, by the fact that before the war 34 per cent of total calorie supplies were obtained from potatoes and grain products, whereas in 1946 these increased to 42 per cent.

148.] The figures on nutrient supplies are equally striking. The numbers of calories have varied somewhat, and on some occasions, notably in 1940 and 1941, supplies were probably near or even below the sufficiency level. The provision of animal protein has fluctuated, reaching a low level of 36 g. per head daily, or 84 per cent of the pre-war supply, in 1941, but has improved in recent years, to reach about 44 g. in 1946–7—that is, slightly more than before the war. Supplies of total protein, minerals and vitamins have increased substantially as compared with the pre-war supplies except, perhaps, for ascorbic acid and for vitamin A. The picture emerging from the studies of

food consumption levels is that the character of the nation's diet has changed considerably since the beginning of the war, but that the supplies of many foods, particularly those of animal origin, have not been reduced as much as is commonly believed by some sections of the population. While during the years 1940 and 1941 the calorie supplies fell, the supplies of most of the essential nutrients in the national diet have undoubtedly increased.

149. Surveys of food intake are the other source of direct evidence on the levels of food supplies, and the results of the National Food Survey and other inquiries confirm broadly the picture emerging from the consumption level inquiries. The average nutrient intakes of the whole of the families studied in the National Food Survey show that, at least in recent years, intakes of all nutrients except calories and ascorbic acid were, as judged against the standards of the U.S. National Research Council (1941), sufficient to meet requirements. The position in regard to calorie intake is uncertain because of the absence of the necessary data, but there appear to have been fluctuations, with peak intakes in 1944 and 1945. The question of calories is indeed crucial in any review of the nutritional position, and it is unfortunate that a more precise estimate could not be made.

150. There seems little doubt that in both 1941 and 1943 there was some underfeeding and unequal consumption of the more palatable and expensive foods by the different sections of the population. The Committee, however, has no means of estimating whether the position has improved or deteriorated between 1943 and 1947, and thus is unable to determine whether or not such groups as families with a large number of children, who were known to be underfed before the war, are now receiving a sufficient diet.*

151. The evidence from individual surveys is limited mainly to children and expectant mothers. It points to an improvement in the diets of the working classes compared with conditions before the war and suggests that people who had no special privileges could, and did, get enough calories during the war period, although this involved considerable changes in food habits. The Committee could not fail to be impressed by the paucity of the data available on individual diets. Thus, all the information relating to children was collected in 1943–4 except for a small survey (54 children) in 1947. There are no useful data for adolescents or industrial workers and only one recent series of data for expectant mothers. The Committee thus finds itself in the same position regarding the results of individual surveys as it does in regard to those from the National Food Survey; there is not sufficient information from which to assess the food consumption of the various sections of the population in recent years.

152. The indirect evidence derived from consideration of the system of food control is somewhat difficult to assess in quantitative terms. Certain details of that system must themselves have done much to improve the general standard of nutrition, among the beneficial measures being the national milk scheme, the milk in schools scheme, the vitamin scheme, the raising of the extraction rate of bread and its fortification with calcium, the fortification

* It is understood that the Ministry of Food has already taken steps to analyse in greater detail the data from its family food surveys. The potential value of such data to research workers and others is fully recognized, and a Committee, which includes non-Government experts, was set up in 1948, to examine all the available material, advise upon the most useful kinds of analyses and supervise the preparation of comprehensive reports, which will be published in due course.

TECHNOLOGICAL RESEARCH

of margarine with vitamins A and D, the impetus given to the consumption of potatoes and vegetables, and the whole system of price control. The extension of rationing to cover more and more of the food supplies has meant that the consumption of the available foods has become more and more equal, although at least up to 1943 it was for many foods still unequal. There is no information available subsequent to 1943. The rationing system has resulted in an increased intake of many essential nutrients among the poorer families, whose pre-war consumption of many foods was low. On the other hand, it has reduced the consumption of certain foods by the richer classes. Assessments of the availability of rationed and unrationed foods, both to the population as a whole and to families of a particular constitution in one locality, show that in recent years the diets of large sections of the population have been austere and that towards the beginning of 1948, when both potatoes and bread were rationed, many families might not have been getting enough to eat.

153.] Another aspect of the rationing system which may affect the amounts of food eaten by those with large calorie needs is the amount of acceptable "spreads" available. An insufficiency of these may prevent the eating of enough "fillers" required to meet the full calorie needs. Such groups as manual workers and adolescents may well be those affected. There is no evidence from food surveys to show whether this is so or not.

154.] The conclusion which the Committee has reached from the information available is that since 1939 the diet of the nation has, on the average, deteriorated in variety and palatability, but that supplies of calories have been well maintained and those of most nutrients have increased. It is probable that the changes in food supplies have affected differently the various classes within the population, consumption of many palatable foods increasing among the poorer sections and decreasing among the richer sections. Nevertheless, in spite of the large amount of data which the Committee has considered, direct information about the consumption of food by different groups is disappointingly scanty and it is not possible to determine with any certainty what degree of underfeeding, if any, there has been in the population.

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APPENDIX B

TABLE II

FOOD SUPPLIES PER HEAD PER ANNUM MOVING INTO CIVILIAN CONSUMPTION IN THE UNITED KINGDOM
(From "Food Consumption Levels in the United Kingdom", 1947)

	Lb. per head per annum									As percentage of pre-war							
	Pre-war	1940	1941	1942	1943	1944	1945	1946	1946-7 (provisional)	1940	1941	1942	1943	1944	1945	1946	1946-7 (provisional)
Dairy products (excluding butter (total as milk solids)	38·3	38·2	40·7	48·6	50·0	49·0	49·8	49·4	49·6	100	106	127	131	128	130	129	130
Meat (including canned meat, bacon and ham)—																	
(as carcase weight) ..	131·7	117·1	102·0	108·8	105·6	114·9	106·2	112·7	119·3	89	77	83	80	87	81	86	91
(as edible weight) ..	109·6	98·8	85·6	89·6	86·4	96·1	86·6	89·9	93·3	90	78	82	79	88	79	82	85
Fish, poultry and game (edible weight)	32·8	27·7	20·0	20·5	21·6	23·5	27·8	34·3	35·8	69	61	62	66	72	85	105	109
Egg and egg products (fresh egg equivalent) ..	24·5	22·5	18·7	21·0	22·1	23·2	26·1	21·2	21·1	92	76	86	90	95	107	87	86
Oils and fats (visible) (fat content)	45·0	41·2	39·9	40·0	38·1	38·9	37·0	34·7	33·4	92	89	89	85	86	82	77	74
Sugar and syrups (sugar content)	109·9	77·6	70·9	72·1	71·6	75·7	74·1	79·3	81·7	71	65	66	65	69	67	72	74
Potatoes	176·0	172·2	195·2	233·7	252·9	282·2	274·9	293·2	292·0	98	111	133	144	160	156	167	166
Pulses and nuts	9·6	6·9	7·5	6·1	6·0	7·1	6·4	6·7	7·9	72	78	64	63	74	67	70	82
Tomatoes and citrus fruit (fresh equivalent) ..	46·3	32·0	12·0	21·0	19·0	25·0	32·3	32·2	39·1	69	26	45	41	54	70	70	84
Other fruit (fresh equivalent)	95·2	76·0	47·6	73·2	58·9	68·5	58·5	73·3	78·5	80	50	77	62	72	61	77	82
Leafy, green and yellow vegetables	70·1	73·1	79·9	89·6	83·7	87·9	90·3	80·4	74·9	104	114	128	119	125	129	115	107
Other vegetables	37·3	25·4	29·2	30·0	33·4	36·8	36·8	35·4	40·8	68	78	80	90	99	99	95	109
Grain products	209·8	225·7	256·8	244·9	247·7	251·1	256·3	236·0	231·8	108	122	117	118	120	122	112	110
Beverages	14·7	15·6	14·6	14·0	11·5	12·8	13·7	15·7	16·1	106	99	95	78	87	93	107	110

TABLE III

Nutrient Equivalents of Supplies per Head per Day Moving into Civilian Consumption in the United Kingdom

(From "Food Consumption Levels in the United Kingdom", 1947 (revised))

	Average full intake requirement per head of population (*a*)		Per head per day									As percentage of pre-war							
	1934–8	1946	Pre-war	1940	1941	1942	1943	1944	1945	1946	1946–7 (provisional)	1940	1941	1942	1943	1944	1945	1946	1946–7
Protein—																			
Animal (gm.) ..	—	—	42·7	38·5	35·8	40·4	39·8	41·4	42·2	44·3	45·2	90	84	95	93	97	99	104	106
Vegetable (gm.)	—	—	37·2	40·7	46·7	46·5	45·6	45·9	47·5	45·7	44·3	109	126	125	123	123	128	123	119
Total ..	66	63	79·9	79·2	82·5	86·9	85·4	87·3	89·7	90·0	89·5	99	103	109	107	109	112	113	112
Fat (*b*) (gm.) ..	—	—	130·2	120·7	113·2	119·4	115·5	123·9	116·1	112·1	110·3	93	87	92	89	95	89	86	85
Carbohydrate (gm.)	—	—	377·0	351·0	368·4	364·5	369·5	386·0	383·9	380·9	387·5	93	98	97	98	102	102	101	103
Calcium (mgm.) ..	320	900	693	677	699	838	1,033	1,038	1,047	1,085	1,130	98	101	121	149	150	151	157	163
Iron (mgm.) ..	12	12	12·4	12·7	12·9	15·6	15·9	16·1	14·5	17·2	17·7	102	104	126	128	130	117	139	143
Vitamin A (*c*) (i.u.)	2,600	2,580	3,997	3,685	3,615	3,800	3,567	3,779	3,771	3,729	3,789	92	90	95	89	95	94	93	95
Ascorbic acid (*d*) (mgm.)	71	70	95·7	87·3	82·5	97·9	97·8	107·1	108·8	107·9	109·0	91	86	102	102	112	114	113	114
Thiamine (mgm.)	1·3	1·3	1·21	1·33	1·47	1·74	1·90	2·01	1·83	1·87	1·89	110	121	144	157	166	151	155	156
Riboflavin (mgm.)	1·7	1·7	1·61	1·64	1·59	1·96	2·03	2·09	1·87	1·99	2·04	102	99	122	126	130	116	124	127
Niacin (mgm.) ..	13	13	13·4	13·8	13·1	14·0	14·5	16·0	14·9	17·2	16·9	103	98	104	108	119	111	128	126
Energy Value (Cal.)	2,590	2,550	3,000	2,810	2,820	2,880	2,860	3,010	2,940	2,890	2,900	93	94	96	95	100	98	96	97

(*a*) U.S. National Research Council (1941) recommended dietary allowances.

(*b*) Fats from all sources, i.e., visible fats and also fats obtained in other foods.

(*c*) The American recommended dietary allowances for vitamin A are based on the premise that approximately two-thirds of the vit. A value of the average diet is contributed by carotene and the rest by pre-formed vit. A. In the above calculations an attempt has been made to reduce the total to terms of pre-formed vit. A by assuming that carotene has one-third the value of vit. A. Thus the total pre-formed vit. A content of the diet is taken to be equal to the pre-formed vit. A plus one-third of the carotene content. The N.R.C. requirements have therefore been similarly adjusted.

(*d*) No allowances have been made for cooking losses.

TABLE IV

ESTIMATED QUANTITIES OF CERTAIN FOODS CONSUMED PER HEAD PER WEEK AT DIFFERENT INCOME LEVELS OF THE UNITED KINGDOM

(Data from "Food, Health and Income", Orr, 1936)

Income per head per week ..	Up to 10/-	10/- to 15/-	15/- to 20/-	20/- to 30/-	30/- to 45/-	45/- and over
Percentage of the population	10	20	20	20	20	10
Average food expenditure per week	4/-	6/-	8/-	10/-	12/-	14/-
Total Meat (oz.)	23·1	31·6	37·1	41·5	44·8	49·4
Milk (pint)	1·8	2·8	3·1	3·6	4·6	5·8
Eggs (No.)	1·5	2·1	2·6	3·2	3·6	4·5
Butter (oz.)	3·0	6·5	7·5	8·5	9·5	11·0
Cheese (oz.)	1·8	2·5	3·1	3·6	3·6	2·6
Fish (oz.)	2·7	5·5	8·2	10·4	12·2	13·5
Fruit (oz.)	14·0	21·7	25·8	27·9	30·5	39·3
Vegetables (oz.)	16·0	20·0	27·2	30·6	32·3	34·0

TABLE V

MILK CONSUMPTION ACCORDING TO NUMBER OF CHILDREN IN FAMILY

(Data from Report on a Study of the Diets of 205 Families in the West Riding of Yorkshire, County Council of the West Riding of Yorkshire, 1939)

Number of children in family	1	2	3	4	5–7
Liquid Milk. Average consumption pint per head per week	2·9	2·2	1·8	1·4	1·4
All Milk. Consumption as % of milk allowance	61	41	32	28	24
% below half milk allowances ..	33	71	91	91	97

TABLE VI

CONSUMPTION OF MILK IN ALL FORMS: PERCENTAGES OF REQUIREMENTS

(Data from "The Consumption of Milk among Four Social Classes of Consumers," Bransby, 1946)

Social class	Percentages of Requirements Under 5 years	5–14 years
Lower working	27	56
Working	33	53
Lower professional	42	81
Professional	45	83

TABLE VII

THE PERCENTAGES OF NUTRIENT REQUIREMENTS REPRESENTED BY ACTUAL NUTRIENT INTAKES BY GROUPS SELECTED ACCORDING TO INCOME, WHETHER EMPLOYED OR UNEMPLOYED, AND NUMBER OF CHILDREN IN FAMILY.

(Data from Report on a Study of the Diets of 205 Families in the West Riding of Yorkshire, County Council of the West Riding of Yorkshire, 1939.)

Income per head per week	No. of families	Calories	Protein	Calcium	Iron
Under 6/-	14	81	67	28	65
6/- to 7/11¾	46	91	77	32	78
8/- to 9/11¾	23	91	88	42	90
10/- to 11/11¾	29	98	87	42	99
12/- to 13/11¾	23	98	88	48	100
14/- and over	21	107	103	57	122
Unemployed	41	87	76	34	80
Employed	85	100	88	42	96
2 adults and 5 or more children	20	94	79	34	85
2 adults and 1 child ..	30	116	116	72	143

Note I. These data concern working-class families only, not the whole of the 205 families studied.

Note II. The nutrient intakes were compared with the League of Nations (1936) standards of requirements.

TABLE VIII

PERCENTAGES OF HOUSEHOLDS, PERSONS AND CHILDREN WHOSE WEEKLY FOOD EXPENDITURE FELL BELOW THE STANDARD ESTIMATED COST OF THE ADJUSTED B.M.A. DIET, MAY–JUNE, 1938

(Data from "Milk Consumption Habits", Murray and Rutherford, 1941)

No. of children in household	Households	Persons	Children
0	7·9	7·2	—
1	10·9	11·4	10·9
2	26·4	26·4	26·4
3	51·6	50·9	51·6
4	64·7	63·7	64·7
5	83·3	81·9	83·3
6	87·5	87·2	87·5
7	94·4	94·3	94·4
over 7	100·0	100·0	100·0

TABLE IX

MINISTRY OF FOOD NATIONAL FOOD SURVEY

Food Consumption in the Home—Urban Working-Class Households
(in ounces per head per week, except where otherwise stated)

Food (*a*)	1942	1943	1944	1945	1946	1947 (*b*)
Fats—Total	8·64	8·73	9·19	8·63	8·23	7·89
Butter and Margarine	6·13	6·18	6·34	6·35	6·29	6·25
Sugar and Preserves—Total	13·34	13·90	15·11	14·61	14·97	15·66
Sugar	8·41	8·71	9·05	9·13	9·55	10·15
Milk—Total (equiv. pints)	3·78	4·30	4·41	4·43	4·31	4·37
Liquid (pints)	3·50	3·94	3·97	4·11	3·95	3·96
Cheese	3·58	3·07	2·61	2·49	2·54	2·26
Eggs—Total (equiv. number)	1·40	2·22	2·93	3·01	2·50	2·30
Shell (number)	0·92	0·83	0·94	1·27	1·41	1·60
Meat and Meat Products:						
Rationed Meat and Offals	15·33	15·75	16·14	15·93	16·36	16·27
Bacon and Ham	3·95	4·03	4·55	3·54	3·22	2·20
Rabbit, Poultry, Game, etc.	0·99	0·89	1·07	0·96	0·82	0·58
Cooked and Canned Meats	1·99	1·71	2·42	2·06	2·05	2·33
Sausages (uncooked)	3·99	3·78	4·11	3·87	4·18	4·12
Fish—Total	6·61	6·54	7·61	9·21	10·55	9·54
Fresh and processed	4·94	4·46	5·25	6·71	8·03	7·08
Potatoes (incl. chips)	68·46	71·17	71·34	68·50	73·81	70·78
Other Vegetables—Total	31·35	34·47	37·31	36·32	34·57	30·77
Fresh	28·80	31·72	34·41	32·47	30·49	25·91
Fruit (incl. tomatoes)—Total	12·32	12·76	14·00	15·94	15·68	21·73
Fresh	9·48	10·70	11·67	13·83	13·56	19·07
Cereals—Total	81·51	81·24	83·29	85·44	82·47	83·83
Bread and Flour	67·04	66·56	67·00	67·98	66·05	67·89

(*a*) Beverages and a few miscellaneous foods, e.g., soups, extracts, salad dressings, have been excluded.
(*b*) In this year the sample covered only the nine months January–September.

TABLE X

MINISTRY OF FOOD NATIONAL FOOD SURVEY

Nutrient Content of Food Consumed in the Home—Urban Working-Class Households

	Average Intake per head per day						
	1941 (*a*)	1942 (*a*)	1943	1944	1945	1946 (*b*)	1947 (*b*)
Calories	2,339	2,269	2,272	2,387	2,375	2,307	2,308
Protein—							
Total (gm.)	73	74	73	73	76	78	77
Animal (gm.)	29	34	32	35	35	37	36
Fat (gm.)			86	94	92	86	82
Carbohydrate (gm.)			300	311	310	305	315
Calcium (mg.)	605	672	855	868	875	912	996
Iron (mg.)	12·4	13·5	13·3	13·5	12·7	14·4	14·3
Vitamin A (i.u.)	3,170	2,982 (*c*)	3,071	3,173	2,908	3,112	3,148
Vitamin B—							
Thiamine (mg.)	1·18	1·40	1·55	1·62	1·47	1·55	1·52
Riboflavin (mg.)	1·40	1·54	1·64	1·76	1·58	1·65	1·64
Niacin (mg.)	11·9	11·9	12·7	13·9	13·2	14·5	12·9
Vitamin C (*d*) (mg.)	76	76	83	87	86	89	80
Vitamin D (i.u.)	95	100	112	106	143	174	169

(*a*) Nutrient intake has been calculated from quantities of food consumed except for 1941 and part of 1942, when only details of foods purchased were available. The figures for these periods have been adjusted by making an allowance for the effect of this factor on each nutrient.
(*b*) The sample in 1947 covered only the first three-quarters of the year. Welfare Vitamin Foods were included in 1946 and 1947, but not in previous years.
(*c*) March–December, 1942, only.
(*d*) No allowances have been made for cooking losses. The average for 1947 would have been higher had the fourth quarter been covered, although still lower than in 1946.

TABLE XI

MINISTRY OF FOOD NATIONAL FOOD SURVEY

Nutrient Intakes and Requirements of Working Class Families in 1944 (Drummond, 1948)

	Calories	Protein g.	Calcium mg.	Iron mg.	Vitamin B_1 mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.
Requirements (*a*)	2,350	61·1	873	11·2	1·41	1·98	13·44	66
Intakes	2,387	73	866	13·5	1·62	1·76	13·9	90 (*b*)
Percentages of Requirements	102	120	99	121	115	88	104	136 (*b*)

NOTE.—The values for vitamin A have been excluded because of certain difficulties in their interpretation.

(*a*) U.S. National Research Council (1941) allowances.

(*b*) No allowances for cooking losses. If such allowances are made, the figures are of the order of 40 mg. and 75 per cent.

TABLE XII

Ministry of Food National Food Survey

Purchases of Food per Diet Head Weekly at the end of 1941

Food Expenditure per diet head per week	5/- to 7/-	7/- to 9/-	9/- to 11/-	11/- to 13/-	13/- and over
Milk—Liquid (*a*) (pt.)	2·8	3·0	3·4	3·5	4·0
Condensed (pt. equiv.)	0·1	0·1	0·1	0·2	0·3
Dried (oz.)	0·2	0·1	0·3	0·2	0·4
Cheese (oz.)	2·5	2·8	2·9	3·3	3·6
Butter (oz.)	1·8	2·0	2·0	2·1	2·2
Margarine (oz.)	4·6	4·7	4·7	4·9	5·0
Lard, Suet and Cooking Fats	2·1	2·2	2·2	2·2	2·3
Eggs (number)	0·5	0·6	0·7	0·8	0·7
Meat (*b*) (oz.)	20·0	23·4	28·4	32·5	38·4
Bacon and Ham (oz.)	3·5	3·8	4·2	4·6	4·8
Fish (oz.)	2·2	3·5	5·3	7·1	10·1
Potatoes (oz.)	61·4	69·8	75·2	88·7	106·2
Vegetables (oz.)	21·5	29·0	35·6	43·6	53·2
Fruit (oz.)	2·1	4·9	8·1	11·5	16·8
Bread, Cakes, etc., as Flour (*c*) (oz.)	57·9	62·5	69·6	72·8	66·3
Oatmeal and Oats (oz.)	0·7	0·8	1·3	1·4	2·9
Other Cereals (oz.)	1·4	2·3	3·1	4·5	5·8
Sugar (oz.)	9·8	10·3	10·0	10·4	10·7
Syrup, Treacle, Jam, etc. (oz.)	2·5	3·4	3·7	5·4	7·4

(*a*) Includes milk supplied at school and under the national milk scheme.

(*b*) Includes all rationed and unrationed meat and offals.

(*c*) Purchases almost certainly exceeded consumption, owing to purchasing of flour for stock.

TABLE XIII

Ministry of Food National Food Survey

Consumption of Foods in the Home, per Head Weekly, at the end of 1943

Food Expenditure per head weekly	Under 7/-	7/- to 9/-	9/- to 11/-	11/- to 13/-	13/- and over
Milk—Liquid (*a*) (pt.)	3·6	3·7	3·8	3·9	4·0
Condensed (pt. equiv.)	0·1	0·1	0·1	0·1	0·2
Dried (oz.)	0·2	0·2	0·2	0·3	0·4
Cheese (oz.)	2·6	2·8	3·0	3·3	3·4
Butter (oz.)	1·9	2·0	2·0	2·0	2·2
Margarine (oz.)	3·8	4·2	4·2	4·2	4·6
Lard, Suet and Cooking Fats (oz.)	2·0	2·4	2·4	2·7	3·4
Eggs (number)	0·3	0·3	0·4	0·4	0·5
Dried Eggs (equiv. number)	1·0	1·5	1·8	2·1	2·5
Meat (*b*) (oz.)	18·4	22·7	25·6	30·9	37·9
Bacon and Ham (oz.)	3·6	3·9	4·2	4·2	4·8
Fish (oz.)	2·7	4·1	5·9	8·6	10·5
Potatoes (oz.)	56·0	64·5	72·4	81·9	89·5
Vegetables (oz.)	24·8	31·4	37·7	46·5	57·5
Fruit (oz.)	7·0	9·4	14·0	17·9	28·0
Bread, Cakes, etc., as Flour (oz.)	45·3	51·9	57·6	62·6	71·7
Oatmeal and Oats (oz.)	1·0	1·2	1·4	1·7	1·6
Other Cereals (oz.)	2·2	2·9	3·1	3·7	3·6
Sugar (oz.)	8·1	8·4	8·7	8·8	9·0
Syrup, Treacle, Jam, etc. (oz.)	4·9	6·0	6·5	7·2	7·6

(*a*) Includes milk supplied at school and under the national milk scheme.

(*b*) Includes all rationed and unrationed meat and offals.

TABLE XIV

MINISTRY OF FOOD NATIONAL FOOD SURVEY

Calorie Intakes expressed as % of Requirements for the Last Quarters of 1941 and 1943

Food Expenditure per head weekly	Last Quarter 1941			Last Quarter 1943		
	Persons %	Families %	(a) Calorie intakes as % of requirements	Persons %	Families %	Calorie intakes as % of requirements
Under 7/-	14 (b)	12 (b)	90	10	10	88
7/- to 9/-	32	28	96	31	28	94
9/- to 11/- ..	30	30	104	33	32	99
11/- to 13/- ..	14	17	110	17	18	104
13/- or more ..	10	13	125	9	12	112

(a) Adjusted to relate to consumption and not purchases.
(b) Includes 1 per cent of persons and families spending less than 5/- per head weekly.

TABLE XV

DAILY FREQUENCY OF VARIOUS TYPES OF MEALS

(Data from "The Diets of Families with Children", Bransby, 1946)

Food Expenditure per head per week	Under 5/-	5/- to 7/-	7/- to 9/-	9/- to 11/-	11/- to 13/-	13/- and over
Drink alone or bread and spread	2·3	1·6	1·3	1·1	0·9	0·8
Cooked meal	1·4	1·6	1·8	1·8	1·9	2·1

TABLE XVI

MINISTRY OF FOOD NATIONAL FOOD SURVEY

Purchases (per Head per Week) of Certain Foods by the Same Families at the Beginning and End of 1941

Food Expenditure (per head per week) Group in Jan.-Feb., 1941	No. of Families	Milk		Potatoes		Fresh Vegetables		Bread, etc., as (flour)	
		Jan.-Feb. pt.	Oct.-Nov. pt.	Jan.-Feb. oz.	Oct.-Nov. oz.	Jan.-Feb. oz.	Oct.-Nov. oz.	Jan.-Feb. oz.	Oct.-Nov. oz.
Under 5/- ..	13	2·2	3·0	35·1	65·2	10·9	24·1	60·3	60·0
5/- to 7/-	50	2·7	3·0	54·2	65·6	17·2	24·5	57·9	60·2
7/- to 9/-	98	3·1	3·3	63·5	72·5	21·6	40·2	65·7	66·0
9/- to 11/- ..	97	3·6	3·5	70·9	76·9	27·5	51·2	69·3	70·0
11/- to 13/- ..	66	4·0	3·6	72·3	86·5	29·5	43·6	74·5	72·3
13/- and over ..	44	5·0	3·8	99·5	91·9	43·5	44·8	86·7	70·6

TABLE XVII

Ministry of Food National Food Survey

Percentages of requirements represented by intakes of nutrients
(League of Nations Standards, 1936) at the beginning and end of 1941

Food Expenditure (per head per week) Group in Jan.–Feb., 1941	No. of families	Calories		Protein		Calcium		Iron		Vit. A		Vit. B_1		Vit. C (*a*)	
		Jan.	Oct.	Jan.	Oct.	Jan.	Oct.	Jan.	Oct.	Jan.	Oct.	Jan.	Oct.	Jan.	Oct.
Under 5/-	13	77	90	83	102	35	60	69	100	47	86	54	72	33	85
5/- to 7/-	50	82	90	90	102	46	60	89	100	76	87	65	72	45	86
7/- to 9/-	98	90	97	106	117	57	74	107	122	91	105	77	83	67	125
9/- to 11/-	97	98	102	119	127	71	84	125	139	107	117	87	93	69	152
11/- to 13/-	66	106	106	132	132	83	87	142	153	116	126	95	95	74	135
13/- and over	44	123	112	163	152	109	100	174	169	158	132	118	102	107	141

(*a*) Allowance made for cooking losses.

TABLE XVII

LIST OF INDIVIDUAL DIETARY SURVEYS

A. CHILDREN UP TO 13 YEARS

Period	Author	Date	Place	Class	Number	Age	Method of Survey
Pre-war	Widdowson (1947)	1935–1939	Great Britain 52·5% in London	36·3% Professional 51·7% Upper Working 11·9% Artisan	Boys 435 Girls 481	1 to 18	Weighing
War	Bransby and Wagner (1945)	1943–1944	Two Industrial Towns in England	Elementary School	Boys and Girls 715	5 to 13	Simple Measures
	Roscoe and McKay (1946)	1944–1945	Edinburgh	Poor District and New Housing Estate	Boys and Girls 52	7 to 12	Weighing
			Middle Class Schoolboys				
Pre-war	Widdowson and McCance (1942)	1936–1938		Middle Class	Boys 59	13 to 18	Weighing
War	Widdowson and McCance (1942)	Spring 1942		Middle Class	Boys 52	13 to 18	Weighing

B. ADULTS

Pre-war	Widdowson and McCance (1936)	1935 1935		Middle Class Middle Class	63 Women 63 Men		Weighing Weighing
War	Widdowson and Alington (1941)	Mar. 1941		Middle Class	57 Women		Weighing
Post-War	Doraiswami and Yudkin (1948)	1947			34 Women		Weighing

C. PREGNANT AND LACTATING WOMEN

Pre-war	McCance, Widdowson and Verdon-Roe (1938)	1937	Merthyr Tydfil, Gateshead, Bermondsey, Camberwell, Professional in various parts	Six Classes according to Income	120 Pregnant Women		Weighing
War	Bransby	1942	Shoreditch	At Infant Welfare Centre	36 Lactating Women		Homely Measures
	Oxford Nutrition Survey	1943	Shoreditch	At Infant Welfare Centre	23 Lactating Women		Weighing
	Social Survey	1943–1945	Shoreditch	At Infant Welfare Centre	51 Lactating Women 10 Pregnant Women		Homely Measures
	Roscoe and McKay (1946)	Feb.-Sept. 1945	Edinburgh	23 Wives of men in Forces. 12 Wives of Skilled Artisans	35 Pregnant Women		Weighing
Post-War	Hobson (1948)	1947	Bristol	Ante-natal Clinic	111 Normal Pregnant Women		Weighing

TABLE XIX

A Weekly Consumption of Certain Foodstuffs in Groups Surveyed by the Individual Method

	Middle Class Adults (Widdowson and Alington, 1941)			Middle Class Schoolboys (Widdowson and McCance, 1942)						Children and Adolescents 6–18 years (Widdowson, 1947)	Pregnant Women (McCance, Widdowson and Verdon-Roe, 1938)
	1935		1941	1936–37			1942			1935–39	
Oz. per week	Men	Women	Women	A	B	C	A	B	C		
Butter eaten on bread	11·7	9·8	3·7	10·1	9·2	10·9	2·0	2·0	2·3	6 to 12	7·0 to 9·8
Margarine eaten on bread				0·0	0·0	0·0	3·4	3·1	3·8		4·2 in poorest group
Cheese	4·9	2·9	1·3	0·5	0·7	1·6	3·0	1·7	2·3		
Eggs (number) ..		4·2	3·2								
Sugar	16·7	7·4	4·5	17·3*	16·3*	13·5*	3·0*	3·8*	4·3*	9 to 18·5 Average about 12	
Bacon	10·2	4·4	3·9	2·2	3·4	2·0	3·4	1·4	7·0		
Rationed Meat ..	34·5	19·7	11·4	28·4	24·1	20·7	15·5	6·6	19·7		

* Not including sugar used in cooking.

TABLE XX

Milk Consumption

Monthly Averages (Million Gallons) for Calendar Months
(Data from the "Monthly Digest of Statistics")

	Total (*a*)	Liquid Sales					Used for manufacture (*b*)
		Total	National Milk Scheme		School milk	Full price	
			Free	Reduced price			
1939 ..	108·3	72·0	—	—	2·1	69·9	36·3
1947 ..	121·3	109·1	0·2	15·6	4·3	89·0	12·2

(*a*) Excluding milk sold outside the Milk Marketing Schemes.
(*b*) For manufacture into milk products, including cheese made on farms.

TABLE XXI

Consumption of milk in Various Towns in November, 1935 and November, 1943

(From "The Farmer and Stockbreeder", April 11, 1944)

Town	Nov., 1935 (pints per head per day)	Nov., 1943 (pints per head per day)
Northern Division—		
Newcastle	0·25	0·50
Stockton	0·25	0·50
South Shields	0·18	0·47
Gateshead	0·17	0·55
Seaham	0·16	0·56
Jarrow	0·15	0·48
Wallsend	0·12	0·53
North-Eastern Division—		
Harrogate	0·53	0·41
Bradford	0·30	0·45
Huddersfield	0·29	0·43
Hull	0·27	0·54
Sheffield	0·27	0·51
Halifax	0·26	0·50
North-Western Division—		
Southport	0·49	0·49
Manchester	0·40	0·52
Blackburn	0·30	0·54
Bolton	0·28	0·47
Carlisle	0·27	0·52
Maryport	0·19	0·40
North Midland Division—		
Kettering	0·45	0·48
Derby	0·44	0·54
Lincoln	0·36	0·55
Midland Division—		
Birmingham	0·54	0·61
Wolverhampton	0·37	0·54
Stoke-on-Trent	0·24	0·52
Eastern Division—		
Luton	0·50	0·58
Norwich	0·43	0·48
Wisbech	0·33	0·48
Southern Division—		
Salisbury	0·53	0·42
Portsmouth	0·45	0·50
Southampton	0·44	0·51

TABLE XXII

AVERAGE AMOUNT OF LIQUID MILK PURCHASED IN 1941 AND 1943 BY GROUPS WITH DIFFERENT EXPENDITURE ON FOOD

(Data from "Milk in Relation to Human Nutrition", Kon, 1945)
Pints per Head per Week

Food Expenditure per head per week	1941			
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Under 7/-	2·5	2·6	2·5	2·8
7/- to 8/11	3·0	3·0	3·0	3·0
9/- to 10/11	3·5	3·3	3·3	3·3
11/- to 12/11	4·0	3·8	3·8	3·4
13/- and over	4·8	4·5	4·5	3·9
Average for all Groups ..	3·3	3·2	3·4	3·2
Food Expenditure per head per week	1943			
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Under 7/-	3·4	3·5	3·3	3·6
7/- to 8/11	3·5	3·8	3·8	3·7
9/- to 10/11	3·6	4·2	4·1	3·8
11/- to 12/11	3·6	4·5	4·1	3·8
13/- and over	3·7	4·8	4·4	4·0
Average for all Groups ..	3·6	4·1	4·0	3·8

TABLE XXIII

AVERAGE CONSUMPTION OF LIQUID MILK

(Data from "Milk in Relation to Human Nutrition", Kon, 1945)
Pints per Head per Week

Milk	Aug. 24–Oct. 24, 1942		September, 1944	
	Middle class	Working class	Middle class	Working class
Retailed liquid	4·15	2·92	3·54	2·92
National scheme	0·34	0·72	0·33	0·80
School milk	0·13	0·26	0·11	0·24
Total ..	4·62	3·90	3·98	3·96

TABLE XXIV

INCREASE IN NUMBER OF MEALS IN CANTEENS AND BRITISH RESTAURANTS
(Data from "How Britain Was Fed in Wartime", H.M.S.O., 1946)

SCHOOL MEALS		BRITISH RESTAURANTS		
	Per cent of School Children taking School Meals		Number	Total Meals per day
June, 1940 ..	2·7	June, 1941 ..	777	167,000
May, 1941 ..	5·1	Dec., 1941 ..	1,207	325,000
May, 1942 ..	12·8	Dec., 1942 ..	1,959	568,000
May, 1943 ..	22·4	Dec., 1943 ..	2,119	619,000
June, 1944 ..	30·7	Dec., 1944 ..	1,931	540,000
June, 1945 ..	37·0			
June, 1946 ..	43·0			

MEALS IN INDUSTRIAL CANTEENS AND CATERING ESTABLISHMENTS, STAFF DINING ROOMS, LUNCHEON AND OTHER CLUBS

	Number of Establishments	Number of meals per week
May, 1941	14,700	16,600,000
Jan., 1942	23,700	53,400,000
July, 1943	31,700	60,600,000
Dec., 1944	34,800	62,200,000

TABLE XXV

Calories Available to a Normal Adult, excluding Outside Meals

	Bransby and Magee (1947) Potatoes not rationed	Bransby and Magee (unpublished) Potatoes rationed	Mills (1947) Potatoes rationed	Schulz (1948a) Potatoes rationed	Statements in House of Commons (Nov. 11, 1947) Potatoes rationed
(*a*) Rationed Foods	1,840	1,679	1,427	1,461	1,300*
(*b*) Points Foods		(Points foods, 200)	254	(including *c*)	
(*c*) Personal Points			84	315	190
(*d*) Potatoes	390				
(*e*) Unrationed Foods	110	141	150		
Total	2,340	1,820	1,915	1,776 (excluding *e*)	1,490 (excluding *c* and *e*)

* Not including eggs.

TABLE XXVI

ESTIMATE OF CALORIES AVAILABLE TO A FAMILY OF ONE MALE MANUAL WORKER, WIFE AND 2 CHILDREN AGED 12 AND 6 YEARS

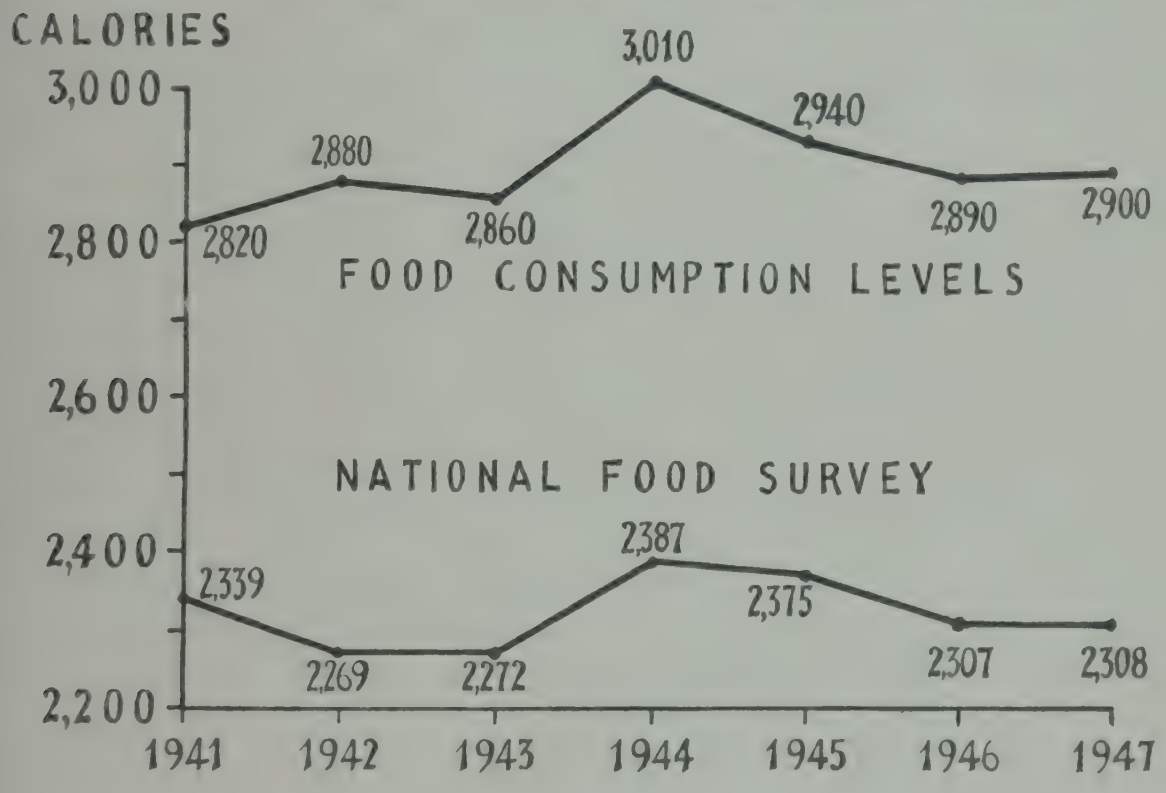
	Controlled Foods	Vegetables, Fruit and Fish	Potatoes	Total
Man	2,060*	110	160	2,330
Wife	1,600*	110	160	1,870
Child aged 12 ..	2,040*	110	160	2,310
Child aged 6 ..	1,755*	110	160	2,025
Average per head ..	1,864	110	160	2,134

* According to the estimate of Bransby and Magee (1947).

FIGURE I

TRENDS OF CALORIE CONSUMPTION 1941-1947

According to "Food Consumption Levels" and the National Food Survey



APPENDIX C

THE "GAP"*

(1) The estimates given in "Food Consumption Levels" should not be used for comparison with estimates obtained from surveys of actual foodstuffs consumed by families or estimates of amounts consumed per head, based on rations and possible amounts of unrationed foods. Much confusion and misunderstanding have been caused by the indiscriminate use of the two estimates of average consumption of calories per head given by (1) "Food Consumption Levels" and (2) the National Food Survey (Figure I). In 1945, 1946 and 1947, the average numbers of calories consumed per head per day according to (1) were

* See paragraph 71

2,940, 2,890 and 2,880; according to (2) the numbers were 2,375, 2,307 and 2,308. There are gaps of 565, 583 and 572 Calories between the two estimates. These gaps can be explained, in part, as follows:—

(*a*) The samples of the population selected for the National Food Survey contain a higher proportion of young children than does the population as a whole; allowance for this would raise the average consumption by some 50–100 Calories per head.

(*b*) The National Food Survey does not include sweets; allowance for these would add some 85 Calories.

(*c*) The Food Consumption Levels do not take into account losses in the shop and in "cutting up". The Ministry of Food allows a percentage addition on permits to cover cutting up, weighing-up, breakages, etc.; for example, butter and cooking fats 3 per cent, margarine and sugar 1 per cent, cheese 7½ per cent, preserves 2½ per cent, eggs 10 per cent (to cover temporary demands). These items should, in part, be subtracted from the amount going into consumption and, in part, be added to the amount actually consumed (a consumer who gets 2·06 oz. of butter in place of his ration of 2·00 oz. counts it as 2·00 oz.); they will account for about 50 Calories.

(2) There remain gaps of 355, 373 and 362 Calories. The National Food Survey does not include meals taken in canteens, schools and restaurants. There is no satisfactory estimate of the number of calories supplied by these "outside" meals. The families included in the National Food Survey did record the numbers and types of "outside" meals eaten by members of the families, but the Ministry of Food points out that these records are not sufficiently representative of the whole population to account for the total quantities of food issued to restaurants and canteens.

(3) The total number of main meals and *minor meals* (e.g., *teas and buns*) served daily in canteens (civil and Service), hotels, cafés, clubs and all catering establishments "outside the rations" in Great Britain is over 26 million. Of these just over 14 million are served in hotels, restaurants and similar eating places, nearly 2 million in staff dining rooms, civic restaurants, clubs and offices, over 5 million in class B canteens, over 3 million in class A canteens and similar catering establishments, including workers' hostels, and about 0·5 million in canteens for Service, Police and National Fire Service personnel. Meals served in school canteens and youth centres amount to about 2·5 million daily for a 5-day week; this is equivalent to an average of 1·9 million per day through the week. The Scientific Adviser's Division of the Ministry of Food calculated that the calorie content of rationed food *only* for one main meal plus one beverage in November, 1947, was:—

Industrial Canteens, Category A	1,095
Industrial Canteens, Category B	950
School Canteens	752
Normal Catering Establishments	406

But the allowance to Category A canteens includes 9 oz. of bread and 12 oz. of potatoes, and it is found that men will rarely eat such large amounts of filling foods before an afternoon's work. In the numerous surveys that have been made Industrial Canteen (including Category A) dinners usually supply 750 to 850 Calories. School meals supply about 600 Calories to juniors and 700–800 Calories to seniors. If the following allowances are made for the calorie values of meals:—

Industrial Canteens A	1,000 Calories
Industrial Canteens B	800 „
Staff Dining Rooms, etc.	700 „
Service, Police, N.F.S.	800 „
Commercial Restaurants, etc. ..	400 „
Schools	700 „

the average per meal works out at 600 Calories. This would be equivalent to an extra 350 Calories per head per day if spread evenly over the whole population. These estimates may be some 100 Calories too high, as the average of commercial restaurant meals (which include meals of tea and cake supplying about 100 Calories) may supply well under 400 Calories, and it is not known what proportion of industrial canteen meals are minor meals. But the greater part of the gap is accounted for.

(4) It must be remembered that in order to obtain the estimate of amounts of food "going into consumption" allowances are made for losses at various stages in the course of distribution. The Committee has not received any evidence of a critical study of the estimates of these losses. On the other hand, the accuracy of surveys of family food consumption has been studied critically. Considerable amounts of potatoes and other foodstuffs intended for human consumption are used for feeding poultry. Domestic poultry keepers may keep up to 25 hens, a number that cannot possibly be fed without distraining on food intended for human consumption. This food would not appear in the budgets of urban

working-class families, which are not a fair sample of the whole population. Wealthier families and farmers may get disproportionately large amounts of food, and in some country areas rationing is lax. Consequently consumption by the urban working-class is not a fair measure of the average consumption of the population, nor is average consumption a fair measure of consumption by unprivileged families.

(5) The above examination of the "gap" between the average calorie consumptions found in the National Food Survey and in "Food Consumption Levels" shows that the difference between them can satisfactorily be explained, and that when appropriate allowances are made for the differences in the methods of investigation, there are no serious discrepancies between the two estimates. The fact that many adjustments have to be made to bring the two estimates into line leaves no room for doubt that they relate to different things and are thus neither interchangeable nor directly comparable.

(6) The same sort of "gap" exists for other nutrients, but the Committee has not examined it for anything but calories. Theoretically, it should be possible satisfactorily to explain the "gap" for any nutrient, but there are special difficulties in regard to some nutrients—for example, the vitamins—because of the scarcity of information about the vitamin content of meals eaten outside the home. The latter are especially important in regard to some nutrients—for example, ascorbic acid—and this is a further complicating factor in attempting to explain the "gap" for these nutrients.

IV CLINICAL ASSESSMENT OF THE NATION'S HEALTH IN TERMS OF NUTRITION

155.] Evidence as to the effects of wartime diet on health has been sought from four main sources: (i) statistics of mortality and morbidity; (ii) data on growth and development; (iii) clinical data (including radiological information); (iv) biochemical data (including measurements of dark-adaptation).

1. VITAL STATISTICS

Mortality Statistics

156.] Mortality and morbidity are affected by many factors, among which are changes in the environment and in methods of medical treatment. While it is to be expected that an improvement in diet which results in an improvement in health will be reflected in reductions of mortality and morbidity, it is not possible to ascribe such reductions to changes in nutrition unless it can reasonably be assumed that there have been no changes in other factors which might themselves have been responsible. It must be remarked that, over the past few years, there have been a number of notable medical discoveries the use of which in clinical practice has had a powerful influence on the chances of survival.

157.] There is little experimental evidence on the effect of diet on mortality and morbidity except in connection with pregnancy and childbirth, on which a good deal of information has accumulated in recent years. Studies in Toronto (Ebbs *et. al.*, 1941, 1942) and Boston (Burke *et al.*, 1943) showed that the incidence of toxaemia and the complications of pregnancy and the number of premature births and stillbirths were less among well fed than among poorly fed women. The Toronto investigation also suggested that there was less illness and mortality during the first six months of life among babies from well fed mothers. It was shown in Glasgow (Cameron and Graham, 1944) that mothers with full-term infants had received better diets than those with premature infants, and the study in London made for the People's League of Health (1942) suggested that a supplement of minerals and vitamins during the latter part of pregnancy resulted in a significantly lower incidence of toxaemia and premature births. Further, the work of Baird (1947) showed that the social classes with a high foetal death rate had poorer environmental conditions, including a poorer diet, than the better social classes among whom the foetal death rates were much lower. These investigations leave no doubt that complications and diseases of pregnancy and the number of premature births and stillbirths are greatly affected by the maternal diet during pregnancy; and it is possible that the subsequent mortality and morbidity of the infant are similarly affected.

158.] Tables XXVII and XXVIII of Appendix D show the rates of stillbirths, infant mortality, neo-natal mortality and maternal mortality for England and Wales and Scotland for the years 1931–47. All these rates were falling before the war and, except for temporary setbacks in 1940–1, have continued to fall since the beginning of the war, reaching new low levels in 1947.

159.] These statistics are augmented by those from three recent studies of maternal and infant deaths. First, a comparison of the stillbirth (ante-natal mortality) rates in Scotland in 1939 and in 1945 (McKinlay, 1948a) shows that, although there has been an overall reduction within this period, the difference between the occurrence in different social classes (based on occupation of father) is actually considerably greater in 1945 than in 1939. The improvement has mainly been in Classes* I, II and III, and has affected Classes IV and V only to a slight extent. Comparison of neo-natal mortality rates for the same years shows an improvement in each social class (greatest in Class III, which includes miners), but still shows a substantial difference between the well-to-do (Classes I and II) and the poorest (Classes IV and V). The post-natal (1 to 12 months) mortality rates show the steepest gradient from Class I to Class V, which has not altered significantly between 1939 and 1945; although Classes II, III and IV each show slight improvement, the rate for Class V has slightly deteriorated. McKinlay states: "The special interest attaching to these changes is that throughout the war period pregnant and nursing women were among the dietary priority classes, and it seems to be generally agreed that for them appreciable class-levelling in respect of dietary adequacy took place. In view of the importance no doubt rightly attaching to the influence of unsuitable or inadequate diet in magnifying the early loss of life, the actual findings, for Scotland at least, are rather the reverse of expectation." In interpreting the findings with regard to ante-natal and neo-natal death rates in the different social classes, it should be recognized that priority rationing during pregnancy could not be expected to overcome differences in maternal physique, which may date from childhood or adolescence.

160.] Secondly, analysis was made of the causes of maternal death in England and Wales (*British Medical Journal*, 1946) and in Scotland (McKinlay, 1947) before and during the years of war. For England and Wales it was stated: "Recent returns have shown that maternal mortality for the country generally has reached the lowest level yet recorded. The national standard of nutrition has been cited as the principal reason for this fall. In view of the publicity this death rate has received, an examination of the individual causes of death under this heading may be helpful in attempting to establish the reason for the decrease." It was shown that the maternal death rate (excluding abortion) declined steadily during the period 1935–44 with the exception of the year 1941. The most noticeable feature is the large reduction in mortality from sepsis, which contributed 56 per cent of the total decrease during the ten years. Another cause of death for which

* The reference is to the social classification used by the Registrar-General. Class I contains professional and, in general, well-to-do people. Skilled workers (e.g., artisans) are in Class III and unskilled workers (e.g., labourers) in Class V. Class II (trade, clerical, etc.) is intermediate between I and III, and Class IV (e.g., farm labourers) between III and V.

improvement appeared in the last few years is toxaemia in pregnancy, which declined from 0·22 per 1,000 in 1941 to 0·10 in 1944. For Scotland it is stated: "The saving of life in the last ten years, even in the last five years, by the diminution of puerperal sepsis mortality, however, outweighs the collective improvement attributable to (the) other causes of death." It is probable that the reduction in deaths from sepsis was due partly to improved methods of treatment, but resistance to infection may itself be influenced by diet.

161.] Thirdly, the infant mortality figures in England and Wales (Fig. II) show that the record low figures for 1947-8 were, in fact, substantially lower than might have been expected if the same average rate of decrease in infant mortality as operated in 1920-39 had continued from 1940 to 1948. (The logarithmic scale used brings this point out rather clearly as on it equal vertical distances denote equal percentage changes.) Comparison of the post-natal and neonatal mortality during the war years shows that a set-back in the post-natal mortality was more than neutralized by an improvement in the neo-natal figures before the end of the war.

162.] There have undoubtedly been notable reductions in the numbers of maternal, foetal and infant deaths between 1939 and 1947, but it seems that they are rather a continuation of processes already in operation before the war than an exceptional depression of mortality due to any particular wartime feature. There has, however, been a great diminution in the rates of neo-natal mortality and stillbirths. In England and Wales in the period 1931–9 there were improvements of 10 per cent and 7 per cent respectively; during 1939–47 the improvements were 24 per cent and 34 per cent.

163.] Tables XXVII and XXVIII show the death rates of children in each year of age from 1 to 5 years and of persons of other ages for the years 1926–47. Throughout the whole of that period there has been a fairly steady decline in the death rate. This was continued subsequent to 1939, except for temporary increases in 1940-1, new low levels being achieved in 1947-8. Figure III suggests that the reduction in mortality in the age groups 45-84 was substantially greater than that to be expected on the basis of the inter-war experience. Of the many factors certainly involved in this striking reduction, improved medical treatment may well have been the most important.

Tuberculosis

164.] The Committee examined the mortality statistics for various diseases, and while in recent years there have been marked changes in the deaths due to some conditions, the only disease that the Committee considered worth discussing in relation to diet is tuberculosis. The Committee had the advantage of receiving a memorandum from Dr. P. M. D'Arcy Hart and of discussion with him at a meeting.

165.] Dr. Percy Stocks presented to the Committee data on the mortality rates for England and Wales due to respiratory tuberculosis, according to age for a number of years, before, during and after the war. These are given in Table XXIX. Table XXX shows the crude death rates from respiratory tuberculosis and tuberculosis in all forms for the years 1931–47. This Table shows that mortality from respiratory tuberculosis was declining rapidly before the war, the rate being 719 per million in 1931 and 516 in 1938. The

rate increased in 1940 and 1941 to 565 and 566, after which there was a fairly steady reduction to a new low record of 453 in 1946.

166.] Table XXIX shows that the incidence among the various age groups in England and Wales has been different in regard to changes in mortality. Compared with the pre-war rates, the rates for children under five years increased on the whole up to 1946–7, and those for children from five to ten years were not reduced below their levels for 1939. The mortality rate for females aged 25–35 years improved from 726 in 1939 to 657 in 1945, but then fell back to 724 in 1946–7; that for females aged 20–25 years fell from 955 in 1939 to 844 in 1944, increasing to 904 in 1946–7. The death rate for men aged 55-65 years altered little between 1939 and 1946-7, but for men over 65 years it increased substantially, while for women of this age group the death rate tended to fall. It must be noted that the deaths from tuberculosis among men aged 65 or more have been tending to increase for many years.

167.] McKinlay (1948b) has published a valuable study of the changes in tuberculosis mortality in Scotland. Referring to the year 1946-7, he says: "If the present rates of mortality are compared, not with immediate post-war values, but with those that would now have been attained had pre-war trends continued to operate, it emerges that the respiratory position is bad and becoming worse. . . . In pre-school children, 0–5 years, death rates in 1946–7 are almost twice as high as they were in the three years immediately before the war, and in school children there has been an increase of more than one-third; in each of these two age groups pre-war there was a definite tendency towards improvement. In younger adults, 15–25 years, the post-war rates were 35 per cent higher than in 1937–9. . . . In more mature years there are still observed comparatively unfavourable changes, but the relative magnitude is less in the old than in the young."

168.] The Committee considered whether the statistics of notifications of tuberculosis could provide any useful information on the changes in incidence in recent years and again had the benefit of the advice of Dr. D'Arcy Hart. The Committee, however, felt that the number of notifications had been greatly affected by the medical examinations on call-up for the Services and by the extension of mass radiography, so that the changes in the number of notifications could not be taken to represent real changes in the morbidity from tuberculosis.

169.] The Committee considers that there is no direct evidence that the diet has influenced the rates of mortality or morbidity from tuberculosis. Two possible explanations of the increase in the rate among older men are: first, that these men have undergone the strain of two wars and in the last war undertook many extra duties, such as those of air raid wardens; and secondly, that the advent of x-ray examination of the chest as part of the routine for any chronic cough brought to light a number of new cases, some of which would previously have been diagnosed as chronic bronchitis.

170.] Another factor which needs to be taken into account in considering the changes in mortality from respiratory tuberculosis is the increasing number of patients on the waiting list for institutional treatment. The Annual Report of the Ministry of Health for 1947 shows that the number of beds empty but temporarily not available increased from 1,911 on 31st December, 1944, to 4,944 on 31st December, 1946, and that at these

two dates the number of beds empty represented 45 per cent and 70 per cent respectively of the numbers on the waiting list. As is said in the Report, "the battle of the waiting list has been a losing one". The many cases awaiting institutional treatment are undoubtedly centres of infection, and these may well have been responsible, at least in part, for the increase in tuberculosis among young children, who are especially susceptible.

Morbidity Statistics

171.] The principal morbidity statistics presented to the Committee were those collected in the Survey of Sickness (Slater, 1946) made for the Ministry of Health. The Committee considered the method of collection of the statistics at some length, but felt that the information provided, at least for minor conditions in which the Committee was particularly interested, was so liable to be influenced by a number of factors as to raise the question as to whether or not the statistics properly measure the extent of, or changes in, their incidence. It was appreciated, however, that such a form of survey might be of value for some purposes and that the information obtained, at least for some major conditions, might be reasonably reliable. No information was available on the amount of sickness certified under the National Health Insurance Scheme, as the Annual Reports published by the Department of Health for Scotland were discontinued during the war. The only other data available to the Committee were the changes in sick absenteeism among London policemen in 1946–7 and in the pre-war years (Bransby, 1949), and among young entrants to the Post Office between the years 1938 and 1946 (Roberts, 1948). The incidence of sick leave increased substantially in all age groups of the Metropolitan Police, and for the older men was about doubled in the years after the war. There were increases in nearly all types of disease for most of the age groups. Between 1938 and 1946 the rate of sick absenteeism of Post Office boy messengers and girl probationers, groups for which the ages were the same in these two years, increased substantially. In the London area the rate roughly doubled. The Committee recognizes that caution is necessary in making inferences from trends in incidence of sick absenteeism, but the magnitude of the increases for the groups for which data are available does at least raise the possibility that for these there has been a real increase in the amount of sickness. Similar data from other large organizations would have been of much interest in this connection.

172.] Statistics produced by the Medical Officer of Rugby School, and reproduced in the table below, show that during the war years there was no increase of morbidity. The fall in the number of boys in the school is due to two causes. First, many boys left earlier, usually at the end of the term preceding their eighteenth birthday, when they joined the Services, instead of remaining often to the July after their eighteenth birthday. In other words, their school life was nearer four years than their previous five years. Secondly, boys whose homes were abroad or had been "evacuated" did not come to the school. Apart from the numbers in the school, conditions of life at school were much the same, except that there were alterations in diet necessitated by rationing and other wartime circumstances. In the years 1940 and 1943 influenza was rampant, and, in addition, mumps attacked 150 boys during one term in 1943.

RATES OF MORBIDITY IN RUGBY SCHOOL

Year	No. in school	No. of admissions to the Sanatorium	Boy days	Average No. of days for boys in Sanatorium
6 pre-war years—				
1933	602	896	5,222	6·0
1934	601	826	5,439	6·6
1935	608	761	4,581	6·0
1936	601	869	4,849	5·6
1937	582	842	4,989	5·9
1938	590	969	6,111	6·3
7 war years—				
1939	552	724	3,950	5·3
1940	495	1,192	7,342	6·2
1941	458	544	3,325	6·1
1942	451	586	3,845	6·5
1943	494	743	4,698	6·3
1944	533	410	2,101	5·1
1945	543	492	3,131	6·3
2 post-war years—				
1946	569	461	2,754	6·0
1947	582	550	2,876	5·2

These figures show that, except for the year 1940, the numbers of admissions to the sanatorium during the war were smaller than before the war, that the numbers of days spent per boy in the sanatorium were approximately the same, and that in the two post-war years the improvement in sickness incidence was maintained. The use of sulphonamides began about 1936 and, although they may have cut short the number of "boy days" of sickness, they have had little effect upon the number of admissions.

173.] During the 1914–18 war and the immediate post-war years Dr. G. E. Friend (1935) showed that there was an increase in the number of fractures at Christ's Hospital. During the recent war this increase has not been repeated. There has been a similar experience at Rugby School.

174.] A memorandum recently published by the Medical Research Council (1948) describes surveys the results of which confirmed the generally accepted inverse relation between the incidence of thyroid enlargement and the iodine content of the drinking water, although they showed also that an iodine level which in a soft water may be adequate to prevent goitre may be insufficient where the water is hard. The Committee has noted with satisfaction that the recommendation contained in this memorandum regarding the prophylactic use of iodised salt is now being implemented.

175.] A further matter of interest is the frequency of statements by general practitioners that there has been a great increase in complaints of vague ill-health. While there is no factual or statistical evidence available, this assertion by the general practitioner represents his opinion formed after long and intimate contact with his patient, and cannot be disregarded. There is no evidence that it is related in any way to the diet.

Discussion

176.] The mortality data available to the Committee all point in the same direction, namely, that death rates were decreasing before the war and that after a temporary setback in 1940–1 the pre-war downward trend was resumed, to achieve record low levels in 1946-8. In Figure III, the mortality

in England and Wales is graphed on a logarithmic scale to demonstrate the rate of improvement between 1921 and 1948 for age groups over 45. It will be seen that, after the initial set-back in 1940-1, the rate of improvement was considerably accelerated, probably mainly due to advances in medical treatment. Figure II shows that, for post-natal mortality, the actual rates in 1940-5 were greater than the expected rates, which, however, were reached in 1946-7. For neo-natal mortality and stillbirths, the pre-war rates of improvement have been much accelerated during recent years. An outstanding feature is the increase in the death rates from respiratory tuberculosis among certain age groups, both in England and Wales and in Scotland.

177.] It can, of course, be argued that since 1939 there has been a deterioration in many environmental factors which might have been responsible for an increase in mortality, an increase which, in fact, did not occur because of the beneficial results of an improved diet. On the other hand, over recent years there have been improvements in methods of clinical treatment and a growing understanding in the practice of hygiene and welfare which have gradually spread to all sections of the population with good effects on mortality rates. Because of the complex nature of the many factors involved, it is not possible to say to what extent, if any, the wartime improvement in mortality rates has been due to changes in diet.

2. GROWTH AND DEVELOPMENT

Children

178.] The growth of children is generally considered a valuable criterion in the assessment of the state of nutrition or environmental conditions. Although the criticism has rightly been made that little is known of the optimum growth rate of children, it remains true that for children of different classes the better the environmental conditions and health record, the better the rate of growth. A good growth rate may thus be taken as an index of good environmental conditions, and a change in growth rate as an index of environmental changes. It may further be argued that children, like adults, may respond to an inadequate diet by a reduction in activity. The rate of growth is affected by factors other than diet; hence no change in growth rates can with certainty be ascribed to changes in diet unless the possibility that it is due to other environmental factors can be excluded.

179.] Little information is available on war-time growth rates of the pre-school child, as no statistics were systematically collected and no special studies were regularly made. It has, however, been shown (Huggett, 1944) that the weights of babies born in four teaching hospitals in London and in one London Borough were lower in 1941 than in pre-war years or in 1942, and that boy babies in Glossop were lighter and shorter in 1940–2 than in pre-war years, but that the physique of baby girls had not changed (Lewis-Faning and Milligan, 1942). The effect of maternal nutrition on the birth weight of babies is still a matter for investigation, but evidence has been presented to suggest that it is affected by dietary restrictions in the latter period of pregnancy. The only other data on pre-school children are those from Glossop, where it was found that the weight gains during the first year of life for the years 1940–2 were greater than the corresponding pre-war

figures. The mean weights of both sexes in the later war years, 1942–4, exceed those in 1940–2 (Lewis-Faning and Milligan, 1944, 1946).

180.] There is a good deal of information on the changes in the height and weight of children attending primary schools. This comes mainly from two sources: first, the annual reports of many of those school medical officers who continued to measure and record the average measurements of their children; and second, a special inquiry made by the Ministries of Education and Health (*Report of the Chief Medical Officer of the Ministry of Education for the Years* 1939–45).

181.] The most striking feature of the measurements recorded in the reports of school medical officers is the absence of any marked change from the pre-war average of the three years 1936–7–8. Small regressions in average heights and weights occurred in some localities during 1940–1–2, possibly due to the fact that the supply of animal foods was lower during 1940–1 than at any other time during the war, that the milk in schools schemes suffered at the beginning of the war and continued to be affected during 1940–1, and that the increase in school meals did not begin until 1942. Where such regressions were observed it was generally the older children (about 12 years old) who showed them. These regressions were, on the whole, made good by 1943.

COMPARISON OF HEIGHT AND WEIGHT DATA FOR 1944 AND THE PRE-WAR PERIOD

Number of localities where 1944 figures were greater than, less than, or the same as pre-war figures

		Greater (*a*)	Less (*b*)	Same (*c*)
Height:	Boys	17	1	3
	Girls	14	2	4
Weight:	Boys	19	2	—
	Girls	20	1	—

182.] The magnitude of the changes in height and weight of children occurring between the pre-war period and 1944 was estimated by calculating, for the 21 localities together, the average change for the age groups 5–15 years inclusive. For both boys and girls, the average increase in height was of the order of $\frac{1}{4}$ in. to $\frac{1}{2}$ in., and of weight, $1\frac{1}{2}$ to 2 lb., representing somewhat less than 1 per cent of the attained height and somewhat less than 3 per cent of attained weight. The increase in weight was somewhat greater among older than among younger children.

183.] In the special inquiry by the Ministries of Education and Health, calculations were necessarily limited to the age-range 9–14 years. Between 1940 and the middle of 1945 the average increase in height was, for boys and girls, of the order of $\frac{1}{2}$ in. (the increase for girls was somewhat greater than for boys), and in weight of the order of 1–$1\frac{1}{2}$ lb. for boys and 3–$3\frac{1}{2}$ lb. for girls; that is, somewhat less than 1 per cent of the attained height, and about 2 per cent for boys and 5 per cent for girls of attained weight.

184.] The analyses, as shown in the table below, of height and weight data included in the annual reports of school medical officers for the years 1946 and 1947 indicate that, on the whole, there was a slight falling away in rates of growth during 1945–7.

NUMBER OF GROUPS (BOYS AND GIRLS COMBINED) SHOWING INCREASE, DECREASE OR NO CHANGE IN WEIGHT GAINS IN 1947 COMPARED WITH 1945

Age—years	+	0	—
5 to 7	16	2	34
8 to 10	6	2	17
11 to 15	17	0	29
Total ..	39	4	80

185.] Information is forthcoming from London and Liverpool on the changes which have taken place in the physique of children belonging to different social classes. The scheme of periodical weighing and measuring in operation in London before the war was suspended on the outbreak of war, but in 1942 was resumed on a restricted scale in a number of schools in the industrial East End Boroughs (which suffered severe war damage) and in suburban residential districts. Children of the residential districts had by 1943 exceeded the corresponding height and weight figures for 1938; the children of the East End Boroughs by 1943 had not quite attained their 1938 levels. This suggests that the East End children had suffered a reduction in annual growth rate between 1938 and 1942–3. By 1947 the children of the residential districts showed an improvement over 1938 figures of 0·4 kgm. in weight and 2 cm. in height, but the children of the East End Boroughs had an improvement of only 1 cm. in height and no significant change in weight (Daley, 1948).

186.] The changes in the weight of children attending schools in good, fair and poor neighbourhoods in Liverpool are shown in the following table, calculated from data presented by the School Medical Officer of Liverpool in his Annual Report for 1947.

% INCREASE IN AVERAGE WEIGHTS IN 1945–7 COMPARED WITH 1937–9 IN LIVERPOOL

	Age—Years	Good	Fair	Poor
Boys ..	5	1·5	3·5	1·3
	8	0·3	3·0	3·4
	12	1·1	1·2	3·3
Girls ..	5	—0·7	2·8	1·8
	8	—0·2	2·5	1·0
	12	—1·1	0·0	2·7

Compared with the pre-war period, the physique of children in poor neighbourhoods improved more than that of children in good neighbourhoods. The results from London and Liverpool are in contradiction. It may be that the relatively poor progress among East End children was due to the bad living conditions, due to war damage. If similar data were available for other parts of the country it would be possible to say with some certainty on what classes of the population the wartime system of food control has had its greatest effect. It must, however, be noted that there are still considerable differences in physique among children of different social classes. Thus Dr. Cohen, School Medical Officer of Sheffield, in his Annual Report for 1947, finds from a survey in 1947 of the physique of children attending schools in different parts of the city: "There is a progressive diminution in height and weight from the good to the medium and from the medium to the poor types [of schools.]" A similar position is reported in the Annual Report of the School Health Department of Glasgow for 1947.

187.] The point must be made in regard to the growth of children that physique was improving before the war. For example, comparison of the heights and weights of London elementary school children in 1905–12 and 1938 showed a considerable improvement at all ages (London County Council, 1940); the same story is told in the annual reports of school medical officers for other localities. The wartime improvement in physique was probably a continuation of a process in operation before the war, but no information is available to show whether the pre-war rate of improvement has been retarded or accelerated since 1939. As in the case of mortality statistics, the effect of the war has really to be judged by comparison of the rate of improvement actually achieved with that which might have been expected had the pre-war trends continued.

Adolescents

188.] Adolescents can be divided broadly into those at school and those at work, but for neither group is there much information. The growth records kept at Christ's Hospital were made available to the Committee by the courtesy of Dr. G. E. Friend and Dr. T. L. Scott, and showed that since the beginning of the war there had been a steady rise in rate of weight increase, which was maximal in 1947. This is in contrast to the experience in World War I, when there was a distinct lowering in rates of weight increase in 1916–9. The interpretation of the growth data of children at residential schools is somewhat hazardous without fairly complete knowledge of other changes which may have occurred in the school regimen. In regard to adolescents at work, boy entrants aged 14–14½ to the Post Office were taller in 1941 and 1942 than before the war; and girl entrants of the same age were taller in 1942 than before the war (Bashford, 1942, 1943).

189.] Dr. T. A. Lloyd Davies and Mr. J. A. H. Lee presented to the Committee growth data of boys and girls aged 14–16 employed by Boots Pure Drug Company, to show that there had been a decrease in growth rates between the years 1941 and 1947, this being most pronounced between 1945 and 1947.

Adults

190.] No significant information is available to the Committee on changes in the physique of adults. The Committee understands that the Ministry of Food started a survey of the weight of adults in factories and offices in 1943, but the only results published or available to the Committee are brief statements in the Report of the Chief Medical Officer of the Ministry of Health for 1939–45 and for 1946. It is stated that, in the years 1943–5, adults 25 to 54 years old had a fairly steady increase of 2 4 lb., but since 1945 there was a decline of about ¾ lb.

Summary

191.] Taken as a whole, the information on growth rates of the children of various social classes of the population suggests that physique was maintained or improved during the war years, with perhaps the exception of 1941, but tended to fall back in the years 1945–7. For a true estimate of the rate of improvement in the physique of children since 1939, comparison should be made between the actual heights and weights attained and those which

might have been expected had the pre-war trends continued. It must, however, be emphasized that the data available are very patchy, only those for school children being adequate. Data for adolescents are indeed fragmentary, and are badly needed in view of the strain which children experience at that stage of life and their heavy demands for food. The Committee regrets that the results of the body weight survey of the Ministry of Food have not been published or made available. The Ministry stated that the interpretation of the results had not proved easy, and that the figures could not be released until the position had been clarified.

3. CLINICAL SURVEYS

Introduction

192.] The state of nutrition of the population of this country is such that it is rare to see people with classical signs and symptoms of deficiency diseases. If these occur they are generally in persons with unusual food habits. The clinical assessment of malnutrition depends largely on the subjective appraisal by the clinician of various signs and symptoms which may or may not be related to under-feeding, and which are not specific for it. In fact, one of the most interesting of the recent findings in connection with the clinical assessment of nutrition has been the demonstration that a number of signs such as corneal vascularization and folliculosis, which formerly were thought by some to be pathognomonic for particular deficiencies, are in the main due to other factors and, at least so far as this country is concerned, not specifically related to the state of nutrition. The clinical examination therefore raises not only the problems of the comparability of assessments by different observers and the consistency of assessments by the same observer, but also doubts of the ability of the clinicians to detect relatively small changes in the state of nutrition which would not be reflected in specific diagnostic features, but in unspecific, elusive and subtle changes. The certainty with which such changes can be detected doubtless depends on the experience possessed by the clinician of the clinical picture in various states of nutrition. Taking all factors into consideration, it is undoubted that small changes in the nutritional state occurring gradually over a number of years cannot with certainty be detected by a single clinical examination. On the other hand, there is little doubt that more substantial changes would not go undetected by experienced clinicians.

Nutritional Assessments made at Routine School Inspection

193.] Before the war the only systematic attempt at an examination of the state of nutrition was made in the school medical service. The unreliability of such assessments was generally recognized and there was an increasing scepticism as to their usefulness; so much so that, in the system of routine medical examinations in schools coming into operation in 1947, the classification into nutritional grades was replaced by a classification according to "general condition". The Committee is of the opinion that small changes in the state of nutrition, especially if occurring gradually, will not be reflected in the relative proportions of the children placed in the various nutritional categories but, on the other hand, that any gross change, either in general health or in the state of nutrition, is unlikely to go unnoticed. There has been little variation in the proportions of the children routinely examined which

have been placed in the various nutritional categories in the past few years. This suggests that there has been no substantial alteration in the state of health or nutrition.

Special Rapid Surveys of Nutritional State

194.] The need for regular information, with the shortest possible time lag, on the state of nutrition of the population, led the Ministry of Health to start in 1942 a series of rapid clinical surveys for the assessment of nutrition. These surveys were begun by Professor Sydenstricker, who came to this country through the generosity of the Rockefeller Foundation, the work being continued by Dr. H. S. Stannus and Dr. R. B. Hawes, and subsequently by other officers of the Ministry. The surveys were of the rapid type, and in the main were restricted to the assessment of the general state of nutrition and of the incidence of certain signs and symptoms which were thought to be associated with under-feeding. Occasionally, biochemical, anthropometric or physical data of different kinds were collected. The surveys were first made in areas which suffered before the war from industrial depression, but later were extended to other areas to give a more representative picture of the country as a whole. School children and expectant mothers first came under examination, but other groups were included later, and since 1946 the surveys were made mainly on adolescents and housewives.

195.] The results (for example, Adcock *et al.*, 1948) have been published regularly by the Ministry, a practice which has been of much value in the controversy on the significance to be attached to the results of such surveys. These show that between October, 1943 and May, 1948, less than 1 per cent of all groups examined were graded as "poor" and that the proportions graded as "good" were 96–98 per cent for expectant mothers, 94·9–100 per cent for other adults and adolescents, and 89–95 per cent for school children. The remainder were graded as "fair". The proportions in the different grades thus changed little in the 4½ years under review.

196.] While it is doubtful, because of the complexities and uncertainties of the clinical assessment, if small changes of the proportions placed in the various nutritional categories can be taken as reliable evidence of changes in the state of nutrition of the groups examined, the figures as a whole provide evidence of the absence of severe malnutrition or of substantial changes in the state of nutrition during the past few years. The point, however, must be made that it cannot be assumed that the position, as revealed for the relatively small group examined, can be taken as representative of that population group as a whole. Thus the working adolescents examined were in the main employed in industrial and commercial undertakings with good welfare and canteen services, although many made little use of the canteens. The difficulties arising in the examination of certain groups of the population are described in the Monthly Bulletin of the Ministry of Health for August, 1948: "Much difficulty has been experienced in obtaining representative samples of housewives. Of the total interviewed the proportion who came for medical examination was of the order of 40 per cent. A sample as small as this obviously could not be regarded as representative."

Rickets

197.] *Infantile Rickets.* In 1943 the British Paediatric Association (*Reports on Public Health and Medical Subjects*, 1944) undertook a combined clinical and radiological survey in 23 areas of Great Britain and Ireland to determine the incidence of rickets in infants aged 3 to 18 months. In Great Britain, the rate of incidence of rickets, radiologically defined, was $2\frac{1}{2}$ per cent before 6 months of age and 4 per cent during the first year of life. In Newcastle-on-Tyne, Manchester, Leeds and Sheffield, the rate of incidence before 1 year of age was 10 to 12 per cent; in Dublin over 8 per cent; and in Belfast considerably higher. Although the clinical assessment of rickets gave higher results than the radiological, it was considered that severe manifestations of rickets were rare. In most of the areas surveyed there were no comparable pre-war figures, but on the scanty evidence available it was concluded that there was no indication of an increase in the incidence of rickets during the early war years.*

198.] *Rachitic Pelvis.* McLennan (1936, 1944) found that contracted pelvis was common in industrial areas in Scotland where the standard of living was bad, and that the contraction had usually been caused by rickets occurring in infancy. He also found that the death of the mother, complications of childbirth, stillbirths, and neo-natal mortality were considerably more frequent when a mother had a ricketty contracted pelvis. Since this deformity was the result of rickets in infancy, no comparison with the incidence of rachitic pelvis due to the effects of defective diet during the recent war years can be made until infants born during this period have reached maturity.

Malnutrition in Old Age

199.] There are few clinical data at present available which can add to the picture obtained from the routine school medical inspections and the rapid clinical survey described above, although information will presumably be forthcoming both from the Carnegie Survey made before the war and from the Oxford Nutrition Survey. Of special interest, however, because of the prominence given to reports of serious under-feeding among the aged, was the information presented by Dr. J. H. Sheldon (1948) in his book, *The Social Medicine of Old Age*. Of 583 old people examined, only 14 (3 per cent) showed signs of malnutrition. Dr. Sheldon found that in nearly every case an adequate reason for poor nutrition could be found. The following is an example: "A man aged 77 keeps house for himself and a son but is too feeble to move far from the house. Not only was he very thin, but his dry skin suggested vitamin deficiencies. He has one cooked meal a day in the evening with his son, and apart from that, eats nothing except bread and margarine for breakfast." It must, however, be remarked that the nutritional assessments were made simply during interviews with the old people in their homes, without any physical examination, and doubt arises as to the significance which can be attached to the findings.

Dental Caries

200.] Mention must be made of the noteworthy changes which have occurred in the incidence of dental caries. Examination of five-year-old

* Reference is made in paragraphs 213–15 below to biochemical evidence of rickets in young children.

children attending primary schools in London (Mellanby and Mellanby, 1948) shows that by 1943 a great reduction had taken place in the incidence of caries, this being further reduced by 1945. Statistics collected in the school dental service in Cambridge show a great fall of the incidence among five-year-old children between 1939 and 1944. It thus seems that there has been a marked reduction in the incidence of caries in school children since 1939. It is, however, to be noted that the Cambridge figures, which go back to 1912, showed a great reduction in dental caries between about 1917 and 1922, after which the incidence increased substantially. While it seems very probable that the improvements in the incidence of dental caries are due to changes in diet, and substantial changes have occurred in the consumption of a number of important foods, both since 1939 and throughout the longer period to which the Cambridge statistics relate, there is not as yet sufficient evidence to ascribe the improvements to any particular item.

4. BIOCHEMICAL DATA

Introduction

201.] Since malnutrition causes alterations in the composition of tissues before alterations in structure or function occur, it might be expected that biochemical methods would detect malnutrition earlier than clinical methods. Further, whereas clinical assessments of nutrition are subjective, biochemical assessments (if the values on which they are based are accurate and precise) are objective and therefore can be interpreted afresh in the future when further knowledge has been acquired. Causes of variation include sex and age, and these have therefore been considered in the following discussion. Unfortunately, in the case of most estimations there are very few relevant published figures, and therefore unpublished data of the Oxford Nutrition Survey have been included. There are unfortunately extremely few comparable estimations obtained on the population before the war. The danger of arguing from data obtained from relatively few subjects and making them applicable to the population of Great Britain is obvious; the Committee wishes to call attention to the paucity of the data, and expresses the hope that more extensive information will be collected in the future.

Calories

202.] There is no proved biochemical method of detecting general deficiency of aliments. It is well known that the blood glucose may remain normal in starved persons, and the Oxford Nutrition Survey confirmed this in the Netherlands in 1945. Estimations of serum cholinesterase may prove helpful (McCance *et al.*, 1948).

Protein

203.] Most of the methods that have been used for estimating serum proteins in recent years are inaccurate; only results obtained by methods that have been carefully checked should be considered. The significance of variations in the level of serum proteins, other than those due to exercise and climate, is not known. It is remarkable that Sinclair reported rather higher concentrations in the serum of semi-starved Dutch children in 1945 than in the serum of English children of the same age; and as high figures

for the plasma of returned prisoners-of-war in 1945 as for the plasma of Oxford students. Persons with famine oedema usually had serum protein concentrations that were within the normal range. It is doubtful whether moderately low concentrations of serum protein, even when found as mean values for population groups, can be regarded as evidence of inadequacy of protein in the diet.

204.] A very large number of estimations of serum and plasma proteins made by the Oxford Nutrition Survey have been submitted to the Committee by Dr. Sinclair. The main conclusions from these figures are:—

(1) In no group was the mean concentration of serum or plasma protein below 7 g. per 100 ml.

(2) The mean concentrations in serum or plasma of groups of Oxford students were consistently higher than the mean concentrations in serum or plasma of other groups of adults investigated except prisoners-of-war. Hoch and Marrack (unpublished observation) found a mean concentration in a group of 33 medical students, laboratory workers and nurses which agrees well with the means obtained from Oxford students in 1943.

205.] The concentration of serum proteins usually falls by about 0·7 g. per 100 ml. during pregnancy. Hoch and Marrack (1948) found that the lowest mean level in the 27th to 32nd week of pregnancy among pregnant women attending the ante-natal clinic at the London Hospital was 6·63 g. per 100 ml. The concentration was under 6·0 g. per 100 ml. in one case only.

206.] Dyson and Plaut (1944) found a mean concentration of 7·12 g. per 100 ml. in a group of 20 laboratory workers in 1943. With the same technique Dyson found a mean concentration of 6·56 g. per 100 ml. in 353 male and female blood donors in 1943; and a mean concentration of 6·78 in Canadian base troops in England in 1943. She suggested that the low concentration in blood donors was due to lack of animal protein in the food; but as the method used by Dyson and Plaut is known to give falsely low results, the argument seems unconvincing.

Iron

207.] The concentration of haemoglobin in the blood is commonly supposed to be related to the adequacy of the supply of iron, or available iron, in the diet. Whatever may be the cause, haemoglobin concentrations have been found to vary with economic status, among other factors. In connection with estimations of haemoglobin it must be remembered that different techniques that have been in general use may give widely discrepant results, and that the results obtained on the same sample of blood by different observers using the Haldane visual method may differ considerably. The Committee has paid attention to these sources of error in assessing the significance of figures which it has studied.

208.] Most of the investigations made before the war were made on special groups of subjects, either those readily available to the investigator—hospital staff, laboratory workers and students—or persons in the lowest income levels. The first groups usually had higher haemoglobin concentrations than the population as a whole. The blood haemoglobin levels found in such

groups during the war should be compared with levels found in similar groups before the war or with similar groups living under favourable conditions, particularly in the U.S.A.

209.] Using such criteria, it appears that low concentrations were found in 1940–2 among school children (Davidson *et al.*, 1943 ; Wills *et al.*, 1942), nurses (Wills *et al.*, 1942), students (Hemingway, reported by Scott, 1942), adult men and women of the working-class (Oxford Nutrition Survey), and pregnant women (Hamilton and Wright, 1942; Davidson *et al.*, 1942).

210.] The results found by the extensive survey organized by the Medical Research Council in 1943 were not altogether satisfactory, but compared favourably with those obtained elsewhere at other times. Davidson *et al.* (1944) found that the levels in the blood of elementary school children and pregnant women in Edinburgh improved after 1942, and Roscoe and Donaldson (1946) reported further improvement among pregnant women in 1944. Other investigations made after 1942 have not revealed any evidence of increase of anaemia except that low values were found in Aberdeen in 1943 by Fullerton *et al.* (1944) among adolescents and nurses, and by Cook *et al.* (1944) among apprentices in Dundee. Dr. Lucy Wills (unpublished observation) thought that there was evidence of deterioration among pregnant women between 1943 and 1947, but the difference was small. A recent sampling (1948) of Edinburgh school children (aged 5 to 12 years inclusive) shows a slight but statistically significant rise in mean haemoglobin level for both boys and girls, compared with the level in 1942 (Donaldson, unpublished data). In a recent investigation conducted by the Ministry of Health the concentrations found were relatively high.

211.] There is therefore some evidence of an increase of anaemia in 1941–2, with recovery in the following years.

Calcium, Phosphorus and Vitamin D

212.] Estimations of those three nutrients in serum, except those of calcium and phosphorus in young children, are not of much use in assessing nutrition. Determination of serum alkaline phosphatase is desirable, but not much information is available concerning the limits of normality at different ages.

213.] Corner (1944) included phosphatase values in her study of rickets in children in Bristol in 1938 to 1941; she found that about a third of the children attending hospitals had definite evidence of rickets. Graham (1944) similarly found that at least a quarter of the infants admitted to a Glasgow hospital suffered from some degree of rickets.

214.] High values of phosphatase are found in the plasma of children with rickets. A large number of estimations have been made by the Oxford Nutrition Survey. The average figures in most groups were normal, but very high figures for all ages were found in a village in Oxfordshire in the late summer of 1942; this may be evidence of deficiency of vitamin D.

215.] The biochemical evidence suggests that some degree of rickets was prevalent in the groups of young children examined during the war.

Vitamin A

216.] Information regarding the vitamin A factor in nutrition may be obtained by estimations of vitamin A in serum, by similar estimations of carotenoids, and by determinations of the rod threshold of the dark-adapted eye. When subjects are placed upon a diet deficient in vitamin A and in biologically active carotenoids, the level of the latter in the serum drops rapidly to zero; the level of vitamin A falls later and much more gradually. After this fall, the rod threshold of the dark-adapted eye may rise. But in general a raised threshold does not necessarily indicate a deficiency of vitamin A because there are many non-nutritional causes; and also the concentration of vitamin A in serum is affected by other factors besides the amount of vitamin A and carotene in the food.

217.] Low serum concentrations of vitamin A were found among apprentices in Dundee by Cook *et al.* (1944) and McIntosh *et al.* (1946); by the Oxford Nutrition Survey among factory workers in 1942 and 1943, and among pregnant and lactating women in 1942–4. Men and women students had high concentration in 1942–3; but men had much lower concentrations in 1944. Relatively high values were found in a small group of hospital sisters and a large series of pregnant women in 1943–6 by Hoch and Marrack (1948).

218.] In 1931–5 Moore (1949) estimated vitamin A in the liver of persons who had been killed by accidents. He continued these estimations during the years 1941–4. The mean amount per g. of liver in 1941–4 in the age group 15–59 years was higher than in 1931–5. This, however, was probably due to a decrease in the proportion of livers coming from Scotland, where liver reserves of vitamin A have been found lower than in England. Among old people and children, the increases in the amounts found in 1941–4 over those found in 1931–5 were not accounted for by differences in the district of Britain from which the samples came. Ellison and Moore (1937) found that livers of new-born babies and babies up to 4 weeks old contained on an average under 50 i.u. of vitamin A per g. On the other hand, Johns, Hoch and Marrack (unpublished observation) in the years 1946–7 found much larger amounts; in only 5 out of 32 cases was the amount as low as the mean found by Ellison and Moore.

219.] In measurements of the final rod threshold of the dark-adapted eye during the war, the Oxford Nutrition Survey found a very low incidence of raised values in students and a varying proportion of raised values in the general population; the highest proportion occurred in Chesterfield in the winter 1942–3 where, in the age group 20–44, only 61 per cent of 23 men, and 71 per cent of 48 women were normal. Robertson and Yudkin (1944) found high thresholds among factory workers in Birmingham and Sheffield; the thresholds of those subjects who took a supplement of vitamin A daily, fell significantly Doraiswami and Yudkin (1948) also found low thresholds among students in. 1947.

220.] The evidence suggests that there has been some sporadic deficiency of vitamin A in the country, but there is nothing to suggest that the incidence is higher than before the war.

Ascorbic Acid

221. The plasma level and urinary excretion of ascorbic acid are related to

the amount in the diet in the immediate past only; both are therefore profoundly affected by the seasonal fluctuations in intake of ascorbic acid, and there tends to be a sharp rise in June-July. With saturation tests, of which the interpretation is debatable, Harris (1940, 1943) found a deterioration between Spring, 1938 and Spring, 1941, and between August, 1941 and August, 1942. Francis and Wormall (1942, 1944) found a deterioration between Spring, 1939 on the one hand, and June to July, 1941 and February, 1944 on the other, but this may not have affected health.

222.] The Oxford Nutrition Survey has found very low levels of plasma ascorbic acid in certain groups at certain times of the year. The mean value for 26 males, aged 20–24, in Accrington in January–February, 1942, was 0·08, and for 19 males in Merthyr Tydfil in June–July, 1942, 0·09; 21 male students in the same age-group gave a mean of 0·16 in February–March, 1943; in age-group 15–19, 103 subjects at the same period had a mean of 0·18, and in June, 1944, 80 had a mean of 0·15. Children examined in May–July, 1943, had much higher values in rural than in urban areas.

PLASMA ASCORBIC ACID—MG. PER 100 ML.
(Figures in brackets signify numbers tested)

	Oxfordshire		London and Birmingham
	Urban	Rural	
Age-group 2–6	0·35 (66)	0·91 (14)	0·40 (37)
Age-group 7–14	0·30 (289)	0·93 (43)	0·47 (192)

223.] The Oxford Nutrition Survey did some 2,300 estimations of ascorbic acid in leucocytes in England during the war, and found very low values in male factory workers in the Winter of 1942–3, and even lower values in the Spring of 1943.

ASCORBIC ACID CONTENT OF LEUCOCYTES—MG. PER 100 G.

		Witney	Oxford
Age-group 15–19 ..	Winter, 1942–3	10·45 (9)	11·09 (11)
	Spring, 1943	8·12 (5)	9·66 (11)
Age-group 20–44 ..	Winter, 1942–3	10·75 (12)	11·05 (20)
	Spring, 1943	9·90 (10)	8·87 (18)

Pregnant women (last trimester) in the first half of 1942 had a mean value of 15·9 (74) and those examined early in pregnancy in 1944 had 15·5 (223); these values are satisfactory. The highest values were found in females in a village in the Summer of 1942: age-group 15–19, 27·4 (7); age-group 20–44, 20·9 (17).

224.] There is strong evidence that there were marked variations in the ascorbic acid factor in nutrition in the population during the war.

General Conclusion

225.] It seems from the rather scanty evidence available that nutrition in relation to the following factors was uneven in the population during the war: protein, iron (if indicated by haemoglobin values), ascorbic acid and

vitamin A. Low concentrations of haemoglobin were found in 1940–2, with general improvement in the following years. In infants and young children there was evidence of rickets, but no evidence that rickets was more common or more severe than before the war. Nutrition in respect of the vitamins of the B complex was probably satisfactory. Uneven biochemical levels imply uneven bodily reserves, but not necessarily an uneven state of health. The Committee wishes to emphasize the need for further research in the interpretation of such biochemical estimations.

5. DISCUSSION

226.] The final assessments of the states of nutrition of the various groups of the population come from a synthesis of the mortality and morbidity, clinical, anthropometric and biochemical data which the Committee has considered. Perhaps the first feature of importance which emerges from that synthesis is the patchy nature of the data available, especially in regard to certain population groups, so that it is difficult to speak with certainty concerning them. But this is not surprising since the methods of assessing nutrition are in the main new and still relatively undeveloped; they deserve to be the subject of more investigation and research. This subject received a great impetus during the war, and the methods of survey and examination now available are much in advance of those known at the outbreak of war.

227.] All the data relating to expectant mothers point to the maintenance of a high level of nutrition. The increased rates of improvement, compared with those found before the war, in neo-natal mortality and stillbirths support this conclusion. There is little information available regarding the pre-school child. The increase in their rate of mortality due to respiratory tuberculosis, both in England and Wales and in Scotland, is a disturbing feature; and there are still some cases of rickets. There can be no doubt that for school children the pre-war fall in mortality from respiratory tuberculosis has been slowed down since 1939. Although physique improved up to 1945 and the state of nutrition as judged by the rapid nutrition surveys was good, the reduction in growth-rates between 1945 and 1947, considered in conjunction with the trends in the mortality from tuberculosis, raises the question whether some adverse factor may be operating. The increasing intake of school milk and meals may suggest that these setbacks are not due to underfeeding, but such an assumption is unwarranted without evidence to support it. Information concerning adolescents, a group with special food needs, is indeed scanty; the fall in mortality from respiratory tuberculosis is a heartening feature.

228.] The Committee recognizes the difficulties of collecting clinical data for groups such as housewives, who do not go out to work, and in the absence of sufficient information can express no opinion about the present state of their nutrition, or changes which have taken place in recent years. It is, however, of importance that the mortality from respiratory tuberculosis among females aged 20–25 years fell between 1939 and 1944 or 1945, after which it increased substantially.

229.] There is also but limited information available in regard to industrial and agricultural workers, a group of special importance on whose working capacity the wealth and welfare of the nation depend. Health and working

capacity are in reality two aspects of a single physiological complex, for these workers, if faced with a shortage of food, must either reduce their activity to maintain their weight and general standard of health, or maintain activity at the expense of weight, and perhaps health. An industrial or agricultural worker asked to make a special effort to increase output may be faced with the same sort of choice. In fact, the capacity to maintain or increase activity, industrial or other, is part and parcel of the clinical picture. Although the rapid clinical surveys report that the physical condition is satisfactory, the Committee cannot express an opinion on the question whether those engaged in manual work have had enough of the right kind of food to enable them to respond to all the calls made on them.

230.] The aged, especially the infirm or immobile, have undoubtedly experienced difficulties in recent years. The Committee believes that the fault lies not with the diet but with the accompaniments of old age, especially the inability to shop adequately and to cook satisfactorily. It has been pointed out to the Committee that a number of aged patients who come into hospital require no specific treatment, except rest and improved diet. The increased mortality from respiratory tuberculosis among older men bears witness to the strain they have borne.

231.] It is indeed difficult to estimate what part, if any, of the high standards of health achieved since the outbreak of war is due to changes in the diet. New low records have been attained in recent years in such sensitive indices as maternal and infant mortality and also in the mortality of other age-groups, although the substantial increases in mortality from respiratory tuberculosis for some age-groups is a disturbing feature. At least up to 1945, there have been improvements in the physique of children. Judged by the levels of 1939, the improvements have been substantial. Yet the effect of the system of food control since 1939 has to be judged against the levels which would have been achieved had the pre-war trends continued. Even then, such a comparison omits the fact that, at least up to the end of the war, other environmental factors have deteriorated in important respects, and the extent to which these have increased mortality cannot be estimated. On the other hand, environmental factors have probably improved since the end of the war, in which period there is the suggestion of a deterioration in health.

232.] Nevertheless, having regard to all the facts and data which have been before the Committee, it would appear to be a fair conclusion that the health of the population as a whole, despite the trials and tribulations of recent years, has been well maintained.

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APPENDIX D

TABLE XXVII

DEATH RATES PER 1,000 LIVING IN AGE-GROUPS IN ENGLAND AND WALES (*a*)

(From Reports of the Registrar-General)

	(*b*) Maternal Mortality	(*c*) Infant Mortality	(*d*) Still-births	(*c*) Neo-natal Mortality	0–	5–	10–	15–	20–	25–	35–	45–	55–	65–	75–	85 and upwards
1931	4·11	66	41	31·5	19·9	2·14	1·47	2·50	3·10	3·36	5·45	9·80	20·6	50·8	123·9	268·2
1932	4·19	64	41	31·5	19·0	2·07	1·39	2·39	3·02	3·21	4·79	9·33	20·1	49·8	121·9	264·6
1933	4·52	63	41	32·1	17·9	2·20	1·43	2·41	3·09	3·34	5·15	9·89	20·4	49·5	126·8	266·2
1934	4·62	59	40	31·4	17·5	2·44	1·43	2·28	2·85	3·10	4·60	9·19	19·7	47·9	113·2	236·4
1935	4·15	57	41	30·4	16·1	2·04	1·32	2·07	2·72	2·99	4·49	8·99	19·6	47·5	114·6	245·4
1936	3·86	59	40	30·2	17·0	1·99	1·21	1·95	2·69	2·82	4·39	9·09	20·1	48·5	118·3	265·5
1937	3·37	58	39	29·7	16·7	1·87	1·18	1·97	2·66	2·89	4·47	9·23	20·6	49·0	120·0	271·7
1938	3·24	53	38	28·3	15·3	1·87	1·19	1·86	2·49	2·65	4·05	8·47	19·0	45·5	110·6	240·0
1939	3·13	51	38	28·3	13·7	1·48	1·03	1·75	2·45	2·60	3·94	8·56	19·7	47·2	119·0	260·6
1940	2·68	57	37	29·6	15·6	1·96	1·40	2·54	3·50	3·44	4·92	10·10	22·6	52·3	130·1	278·7
1941	2·80	60	35	29·0	16·4	2·06	1·37	2·59	3·55	3·53	4·62	8·97	19·8	46·5	114·3	247·2
1942	2·48	51	33	27·2	14·0	1·50	1·04	1·91	3·02	2·92	3·87	7·82	17·8	42·4	102·6	216·8
1943	2·29	49	30	25·2	14·0	1·40	1·04	1·88	3·02	2·97	3·95	8·02	18·0	43·1	106·4	220·2
1944	1·93	45	28	24·4	13·3	1·38	1·05	1·73	2·96	3·01	3·82	7·73	17·6	41·7	100·3	196·5
1945	1·80	46	28	24·8	12·3	1·18	0·91	1·56	2·73	2·67	3·48	7·36	17·3	41·5	100·3	194·5
1946	1·43	43	27	24·5	11·9	0·86	0·76	1·33	2·07	2·10	3·15	7·25	17·4	41·3	102·4	214·5
1947	1·17	41	24	22·7	12·1	0·90	0·71	1·36	1·92	2·03	3·08	7·24	17·5	42·8	108·3	234·4

(*a*) Excluding non-civilian males from September, 1939, and non-civilian females from mid-1942.
(*b*) Per 1,000 live births and still-births. Calculated on the same classification as in use from 1940, and including abortion.
(*c*) Calculated on related live births.
(*d*) Per 1,000 total births (live and still).

TABLE XXVIII

DEATH RATES PER 1,000 LIVING IN AGE-GROUPS IN SCOTLAND (*a*)

(From Reports of the Registrar-General)

	(*b*) Maternal Mortality	(*c*) Infant Mortality	(*d*) Still-births	(*c*) Neo-natal Mortality	1–	5–	10–	15–	25–	35–	45–	55–	65–	75–	85+
1931	5·9	87·6	—	35·8	9·8	2·4	1·5	2·9	3·8	5·8	10·3	21·9	53·0	127·4	274·6
1932	6·3	90·3	—	35·9	10·2	2·5	1·6	2·9	3·9	6·0	10·4	21·9	53·2	128·6	270·1
1933	5·9	84·0	—	37·6	8·0	2·3	1·6	2·9	3·8	5·8	10·5	22·0	53·2	126·5	267·1
1934	6·2	83·4	—	36·2	9·0	2·7	1·6	2·8	3·7	5·5	10·1	21·5	50·6	120·8	255·6
1935	6·3	81·1	—	38·4	6·8	2·2	1·6	2·7	3·5	5·6	10·3	21·7	53·6	130·0	280·3
1936	5·6	87·2	—	37·6	7·6	2·1	1·4	2·7	3·4	5·4	10·7	21·6	53·9	128·5	280·2
1937	4·8	85·0	—	38·2	6·9	2·1	1·4	2·8	3·6	5·6	10·8	22·5	56·0	132·7	307·3
1938	4·9	73·8	—	34·9	6·6	1·9	1·3	2·5	3·1	4·9	9·9	20·8	50·6	120·2	278·4
1939	4·3	72·0	42	36·5	4·5	1·8	1·2	2·4	3·1	4·9	10·1	21·3	52·0	127·3	303·2
1940	4·2	81·9	42	37·2	6·7	2·2	1·4	3·0	3·7	5·5	10·6	23·5	55·5	135·6	343·2
1941	4·7	88·4	40	39·9	6·5	2·3	1·7	3·4	4·0	5·6	10·6	22·0	51·3	143·8	
1942	4·1	75·5	38	35·1	4·3	1·6	1·3	3·1	3·5	4·8	9·3	19·8	46·6	128·7	
1943	3·7	70·1	36	32·9	4·1	1·7	1·3	3·3	3·7	5·0	9·3	20·1	46·8	129·7	
1944	3·0	70·9	32	32·8	3·6	1·6	1·2	3·0	3·4	4·5	8·8	19·5	45·1	123·0	
1945	2·8	56·4	33	28·5	3·3	1·3	1·1	2·7	3·5	4·3	8·7	19·1	45·2	126·1	
1946	2·2	65·0	32	29·9	3·2	1·2	1·0	2·4	3·0	4·0	8·8	19·6	46·9	124·9	
1947	2·0	56·7	30	28·5	3·0	1·2	0·9	2·2	2·9	3·9	8·6	19·6	47·0	108·6	279·2

(*a*) Excluding non-civilian males from September, 1939, and non-civilian females from mid-1942.
(*b*) Calculated on live births prior to 1939 and on total births from 1939 onwards.
(*c*) Per 1,000 live births.
(*d*) Per 1,000 total births (live and still).

TABLE XXIX

PROVISIONAL DEATH RATES FROM RESPIRATORY TUBERCULOSIS PER MILLION, LIVING (*a*)

(Calendar years, except October, 1946, to September, 1947)

(Statistics supplied by Dr. Percy Stocks)

	MALES						FEMALES					
	1931–5	1938	1939	1944	1945	1946–7	1931–5	1938	1939	1944	1945	1946–7
Age in years—												
0– ..	85	64	54	67	65	75	74	44	38	70	69	67
5– ..	42	17	15	24	19	17	43	28	20	24	27	24
10– ..	64	49	31	29	38	24	143	79	85	63	68	66
15– ..	490	348	368	287	266	251	840	605	601	523	512	494
20– ..	963	718	682	537	574	514	1,138	931	955	844	865	904
25– ..	961	739	723	637	632	626	911	728	726	670	657	724
35– ..	1,140	858	859	740	725	672	646	464	470	395	418	401
45– ..	1,368	1,133	1,158	1,077	1,024	1,004	475	340	353	273	288	266
55– ..	1,176	1,085	1,171	1,188	1,149	1,183	394	308	301	253	229	232
65– ..	723	643	678	750	781	794	306	233	237	210	218	223
75 and over	275	237	214	308	285	280	170	148	145	105	126	132

(*a*) Including deaths of non-civilians registered in England and Wales and based on estimated populations inclusive of the Armed Forces at home and abroad.

TABLE XXX

THE CRUDE DEATH RATES FROM RESPIRATORY TUBERCULOSIS AND OTHER TUBERCULOSIS (*a*)

(Statistics supplied by Dr. Percy Stocks)

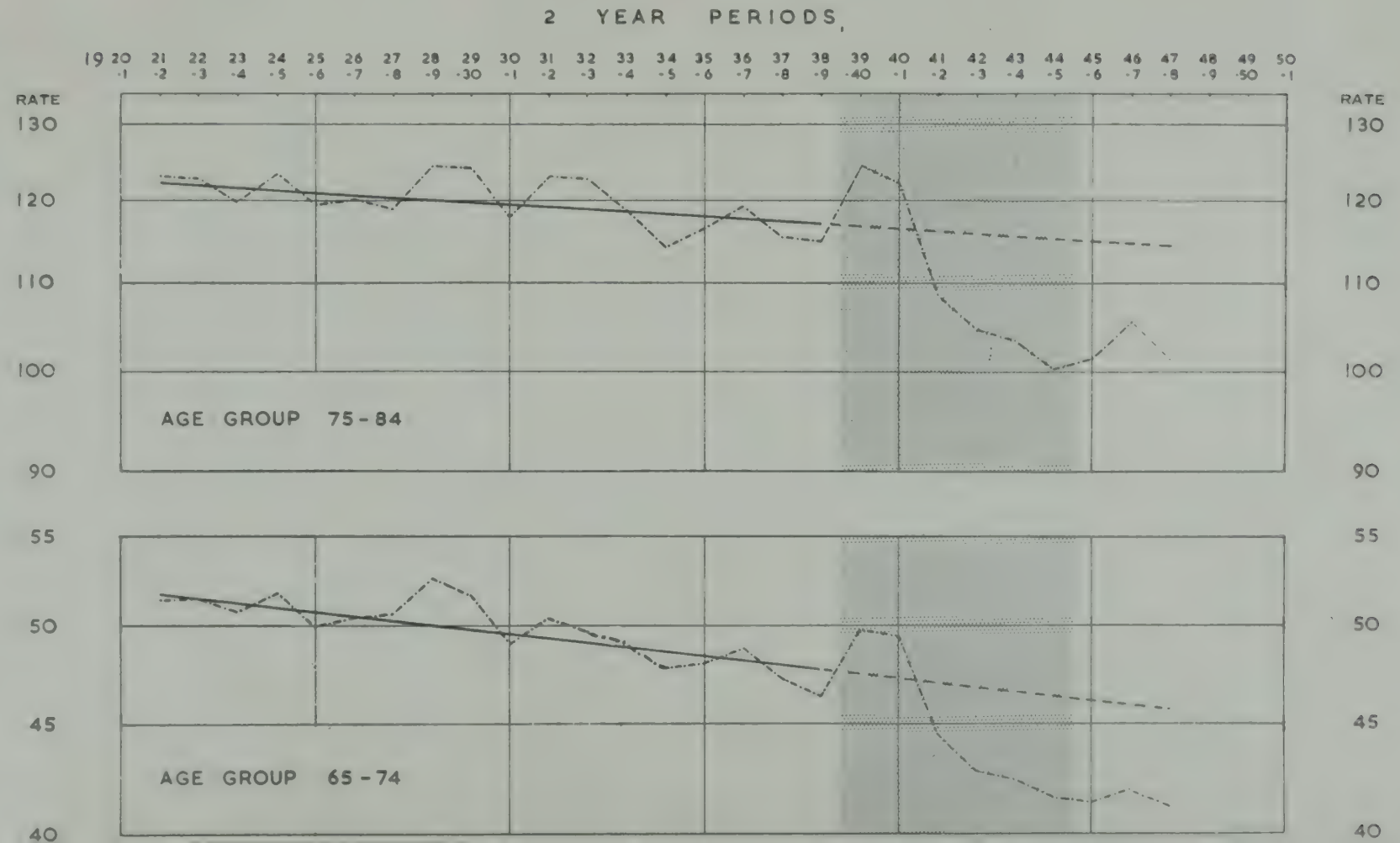
	Respiratory	Other
1931	719	156
1932	666	150
1933	669	135
1934	615	130
1935	587	114
1936	564	109
1937	566	111
1938	516	103
1939	520	98
1940	565	107
1941	566	121
1942	501	109
1943	506	102
1944	474	96
1945	469	92
1946	453	81
1947	468	79

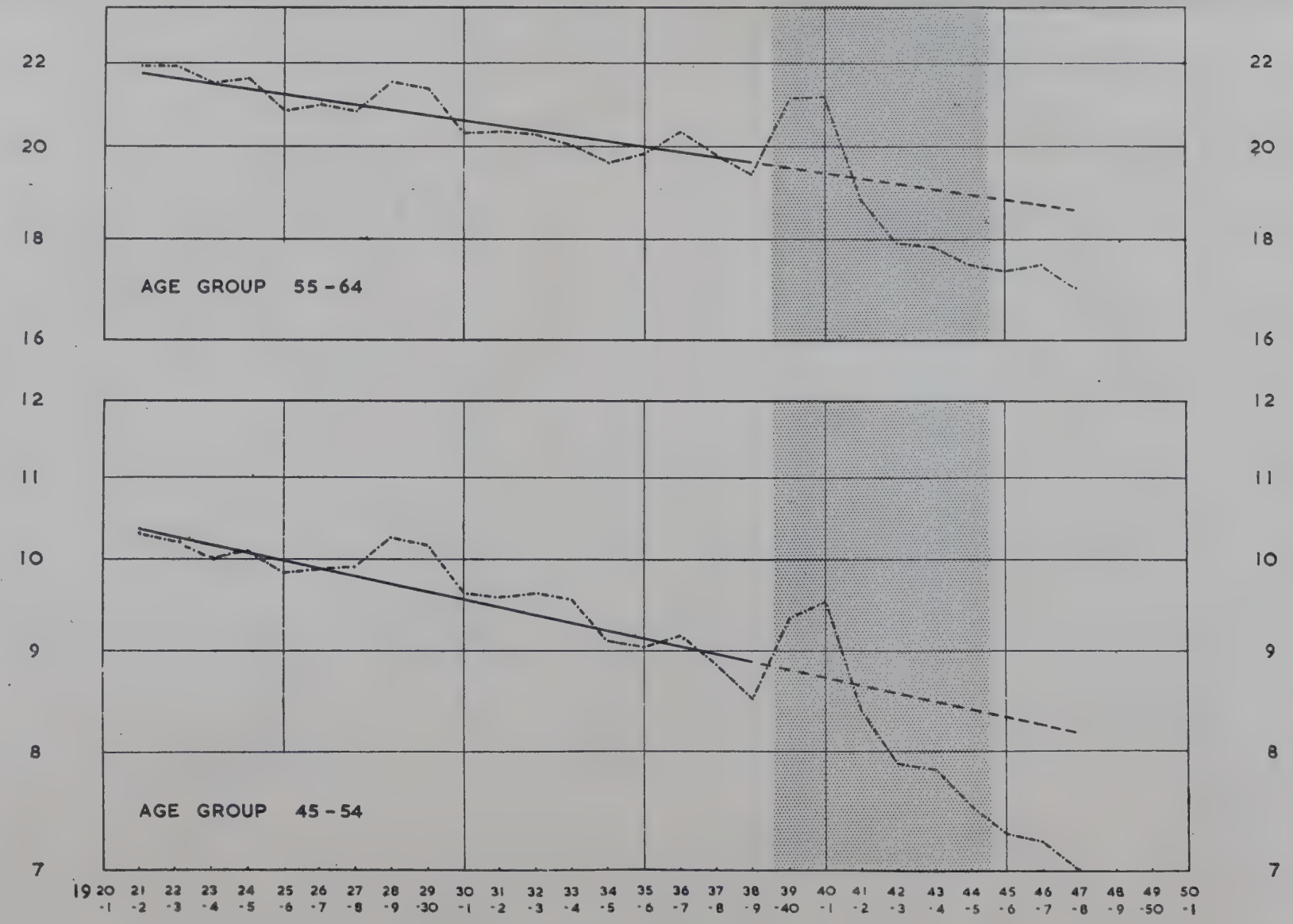
(*a*) Including deaths of non-civilians and based on populations including the Armed Forces at home and abroad. Based on data given in Report of the Ministry of Health for 1947, Appendix B, Table XI.

Fig. III

MORTALITY IN LATER LIFE.
ENGLAND AND WALES 1921-48.

REGISTRAR-GENERAL'S RATES PER 1000 LIVING.
THE TREND OF 1921-39 IS PROJECTED TO 1948.





KEY :

——— TREND FOR YEARS 1921-39 - - - - - 1921-39 TREND PROJECTED TO 1948.

▪▪▪▪▪▪ MORTALITY RATES IN EACH 2 YEAR PERIOD 1921-2 TO 1946-7-8.

V PSYCHOLOGICAL AND PRACTICAL ASPECTS OF NUTRITION

1. INTRODUCTION

233.] In this section of its Report, the Committee first discusses the difficulties resulting from the inevitable food shortages of the war and post-war years, with particular reference to their psychological effects. It then considers the feeding of various sections of the community, its purpose here being not to examine the suitability of the diet as judged by accepted nutritional standards, but to suggest practical measures whereby the food available to particular groups of persons might be used to their greater advantage. Finally, the Committee refers to the importance of established food habits in relation to the adequacy of the diet, and recommends an investigation of any changes in food habits which may have resulted from the diet of recent years.

234.] An important problem of practical dietetics is that of unnecessary loss of nutrients, particularly vitamins, through faulty methods of cooking. The Committee has not thought that it would be appropriate for it to make a detailed examination of this question, concerning which much has already been written. A concise account of the effect of cooking on the nutritive value of food has been given by Callow (1945).

235.] In making recommendations for the immediate future the Committee has assumed that food shortages will continue to make the rationing system necessary for some time to come, but it wishes to make it clear that nothing in these recommendations is to be taken as implying its acceptance of rationing as a permanent feature of the food supply system. The Committee regards rationing, although necessary in present circumstances, as an unfortunate necessity and by no means as a thing that is in itself desirable. It considers that the most energetic measures should be taken so to improve the food position, not merely in this country but throughout the world, as to make it possible for all restrictions in relation to the purchase of food to be brought to an end without detriment to the nutrition of any section of the world population.

2. PSYCHOLOGICAL EFFECTS OF PRESENT-DAY RESTRICTIONS

236.] It is pointed out in other paragraphs* that, to persons accustomed to the traditional British diet, certain constituents of this diet may have a psychological importance out of proportion to their value when regarded from the nutritional aspect. The Committee therefore considers that its survey of the nutrition of the people of this country in recent years would not be complete without a reference to the psychological effects of food shortages and of the difficulties connected with the procuring of food and the preparation of palatable meals.

237.] Through members of Women's Voluntary Services, the Committee obtained a range of comments on food problems as experienced by house-

* See paragraphs 38 and 254–256.

wives in a South London district, in Liverpool and in Glasgow; but it must be emphasized that these comments do not make possible an exact assessment of the nature and volume of popular discontent, no systematic inquiry having been conducted among a representative sample of the population. Moreover, it should be noted that the observations received were written in the early part of 1948, when conditions were in some respects more difficult than they are at the present time and there was special difficulty as regards "bulk" foods owing to the rationing of both bread and potatoes.

238.] It was reported by members of Women's Voluntary Services that, especially for families who could not take meals out, there was difficulty in obtaining sufficient unrationed food to provide, with the rations, really adequate meals. It was pointed out that tinned foods were costly in points and that the high prices of fruit and vegetables made them luxuries for many households. As regards shortages of individual foods, the restricted supply of fat (including cooking fat) was said to be a serious problem. There were complaints, too, of insufficient milk, of a shortage of sausages, and of the poor quality of some meat and offal. Finally, it was clear from the comments received that the necessity of standing for long periods in queues, and carrying heavy shopping baskets home, contributed greatly to the fatigue and irritation suffered by those responsible for family catering. The complaint was made that some tradespeople encouraged queuing by announcing an hour at which the sale of foods in short supply would commence; and that this placed the employed woman at a particular disadvantage, as she could visit the shops only at the beginning and the end of the day. It was said that the struggle to procure enough food left the housewife with little interest in the instruction provided by the Ministry of Food at cookery demonstrations.

239.] The Committee is not to be regarded as accepting as justifiable all the complaints reported to it; and it has recognized in Section III of this Report that some sections of the population may have been better supplied with essential nutrients in recent years than they were before the war. Nevertheless, there can be little doubt that the continuing difficulties associated with the procuring and preparation of food in the post-war period have tended to depress the morale of many members of the community. The monotony in the diet which has resulted from the restricted choice of foods has added to the unattractiveness of meals; and in some cases it may be impracticable for the busy housewife to add variety by using the recipes for made-up dishes recommended by the Ministry of Food, as the preparation of many of these dishes occupies much time. Cookery instructors sometimes show little appreciation of the domestic difficulties of their students, and the Committee thinks it important that prospective teachers of domestic science in schools should during their training be made well acquainted with the home background of the ordinary pupil. The Committee considers also that the practical value of cookery demonstrations could be increased by a more generous allocation of foodstuffs for demonstration purposes.

240.] The physical and mental strain imposed on the housewife may be increased as a result of her consuming less than her proper proportion of the rations. A devoted wife or mother may sacrifice her own share of the more appetizing foods for the sake of a hard-working husband or a growing child, in which case her nutrition may suffer.

241.] The difficulty of entertaining friends has deprived many people of one of their main pleasures. Few can afford to entertain to anything but a limited extent in public restaurants, nor is there the same satisfaction in doing this as in welcoming friends to one's own house. The pleasures of eating have gone from many restaurants of the less expensive type, where the service provided and the standard of cleanliness leave much to be desired. Often there is a dangerous neglect of the teaching of hygiene to those who cook and serve the food, and of the regular supervision of food-handlers. There has been in recent years a progressive increase in the number of outbreaks of food poisoning reported in England and Wales, the figures for the six years 1942 to 1947 being 241, 247, 550, 422, 598 and 765. It may be, however, that some of this increase is accounted for by improved facilities for reporting and investigating these outbreaks. The Committee has noted with satisfaction the efforts now being made by the Ministries of Food and Health, in collaboration with the Central Council for Health Education, to promote hygienic measures in restaurants and other places where food is handled.

242.] It need hardly be said that to catalogue the tribulations of those who are responsible for providing present-day meals is not to disparage in any way the achievements of the Ministry of Food. The Committee is concerned solely to point out the fact, perhaps obvious enough, that dissatisfaction with monotonous and unappetizing, even if adequately nutritious food, and the constant mental irritation of the housewife's daily catering task, cannot but have a depressing effect on the national morale.

3. SOME SPECIAL PROBLEMS

243.] It is important, not only that diets adequate for particular groups of persons should be potentially available to them, but also that arrangements should be made wherever possible to ensure that the opportunities of satisfying their nutritional needs are used to full advantage. The Committee has therefore considered the position of a number of special groups with a view to suggesting methods by which improvements in such arrangements might be effected.

The School Child

244.] It appears that, in general, good provision is made for the school child through the school milk scheme, the arrangements for meals in day schools and the supply of additional rations for pupils in boarding schools. It seems unsatisfactory, however, that during the school holidays the nutrition of the child is in some cases maintained only by sacrifice on the part of the parents. It is true that, at least in theory, the priority allowance of milk continues to be available at those times for consumption on the school premises, but few children attend to receive it and some schools make no arrangements to dispense it. While appreciating the administrative difficulties, the Committee thinks it most desirable that the additional rations, and especially the additional milk, should be made available free of charge to the child in his own home during the holiday periods.

The Industrial Worker

245.] The Factories (Canteens) Order, 1943, lays it down that all factories—the definition of the term including docks and building sites—in which more

than 250 persons are employed shall provide a canteen where hot meals can be purchased by persons employed in the factory. The Factory Department of the Ministry of Labour and National Service is responsible for administering the requirements of the Order. In his Annual Reports for 1946 and 1947, H.M. Chief Inspector of Factories has given an interesting account of progress made during these years, and the Committee is indebted to him for a statement containing still more recent information.

246.] It is estimated that before the war the total number of canteens attached to factories in Great Britain was approximately 700. On 31st March, 1948, there were 4,714 factories employing over 250 persons, and 8,825 smaller factories, with canteens serving hot meals of a substantial kind. In addition, many very small works had made arrangements for workers to buy packed meals or snacks and refreshments during the meal intervals. It appears that the Order referred to above had had the indirect effect of encouraging the smaller firms to provide feeding facilities for their workers, although under no legal obligation to do so.

247.] "The attitude of the workers", writes H.M. Chief Inspector, "is that they expect canteens to be provided. This does not mean that they all use the canteens to buy their midday meal. It is not possible to get reliable statistics. Many factors affect the position and probably a general estimate would not give any real picture. It is frequently found that in factories of comparable size in the same district a very much higher proportion of the workers in one will be buying a meal in a canteen than in another. There is evidence that the smaller the works the higher percentage of the workers seem to stay for their dinner at the canteen. The canteens were set up at a period of difficulty in connection with labour, materials, buildings, etc. The supply of persons qualified to operate them was insufficient and much educational work has been done by way of short courses of training, but much remains to be done to raise the level of qualifications of those employed in this vital service. The quality of the meals served in most of the canteens is good. They have the addition of higher allocation of certain raw materials.* There is a certain amount of monotony in some of the meals, some of it unavoidable under control and rationing shortages, some of it due to lack of early training of managers and cooks, some of it due to a somewhat stubborn desire on the part of many workers to go on with the same old dishes."

248.] There is a staff of 19 specially trained Canteen Advisers who pay day-to-day advisory visits to factories and co-operate in efforts to secure suitable training schemes for canteen workers. Centrally and locally, the Canteens Branch of the Factory Departments works in co-operation with the Ministry of Food.

249.] The arrangement of canteen services at the place of work is one of the most important health and welfare facilities that can be provided by any employer. The Committee strongly advocates the extension of such services,

* Special allowances of meat, fats, cheese and sugar are provided for Category A canteens (serving workers in certain heavy industries), and of meat, fats and cheese for Category B canteens, which include all other industrial works canteens and also roadside cafés for transport workers. All canteens serving industrial workers are entitled also to priority supplies of sugar and fats for manufacturing flour confectionery, coffee essence and starch food powders. There are special feeding arrangements for certain other categories of workers, including seamen, fishermen, miners, night workers, agricultural workers and building workers.

and also an extended provision of civic restaurants by local authorities in accordance with the powers conferred on them by the Civic Restaurants Act, 1947. At the same time the Committee suggests the desirability of the special food allowances provided for industrial workers at works canteens being made available for consumption at home by those industrial workers to whom canteen or similar services are not available at or near their place of employment; and of similar provision being made for young people leaving school at the age of 15 and entering employment of any description where there are no canteen or civic restaurant facilities.

Old People

250.] The elderly are at a serious disadvantage in the struggle for food, especially when they are infirm. For those living alone the food available is inadequate, and many old people cannot afford to buy "points" foods and are physically incapable of standing in queues or even of visiting communal kitchens. Often, too, the elderly are reluctant to go out for meals, even when fit to do so. The commendable voluntary efforts which have been made to institute meals delivery services for infirm old people are handicapped by lack of funds, vehicles and workers.* The Committee draws attention to the importance of the speediest possible development of such services by local authorities, under the provisions of the National Assistance Act, 1948.

Hospital Diet

251.] Despite the priority allowances of certain foods to which hospitals and convalescent homes are entitled, it has been difficult, especially during the time when both bread and potatoes were rationed, to provide adequate meals for the patients and for the nursing staff. But hospital diets were unsatisfactory before the introduction of the rationing system, and even at the present time their deficiencies are due less to shortage of available food than to other causes. The chief defects in the past have been (1) a failure on the part of those responsible to understand the importance of providing adequate meals; (2) the division of responsibility for the catering between the Matron and the Steward, neither of whom in many cases had the experience required; and (3) financial control restricting expenditure on the kitchen department and on food to a level incompatible with good feeding.

252.] In 1943 much publicity was given to hospital feeding as a result of the publication of the valuable "Memorandum on Hospital Diet" by King Edward's Hospital Fund for London. This memorandum points out the desirability of providing a dietary, including cooked breakfasts and suppers, which does not need to be supplemented by "extras" brought in by patients' relatives. It stresses the value of a rightly-planned hospital dietary both as a therapeutic measure and as a means of educating the public in sound principles of feeding. It recommends that catering should be regarded as a main department of the hospital; that there should be a permanent Catering Committee, fully representative of the medical, administrative and executive staff; and that the officer in charge of the catering department should either be a dietitian with adequate experience in large-scale catering or else should act in full consultation with a dietitian. In a "Second

* The Committee is informed that the voluntary societies have increased their work in this field as a result of a conference convened by the Ministry of Health early in 1948.

Memorandum on Hospital Diet" (1945) the whole subject is examined in greater detail and important additional recommendations are made; and in March, 1945, the Ministry of Health issued to all hospital authorities a circular* on hospital catering in which many of the reforms advocated by King Edward's Hospital Fund were recommended. In many hospitals, however, the feeding of patients and staff still falls short of the standard required.

253.] The Committee is fully in sympathy with the recommendations published by King Edward's Hospital Fund, and would stress the desirability of their wider adoption. From reports received by the Committee from a number of large voluntary hospitals where the catering has been reorganized and a trained catering officer appointed, it is clear that the new arrangements have been abundantly justified. The Committee wishes to draw particular attention to the importance of the catering officer being responsible for the feeding arrangements of the hospital at all stages, from the buying of food to the service of meals to the patients. While it is the proper function of the nurse to allot the food and bring it to the bedside, as only she is acquainted with the individual patient's idiosyncrasies and temporary state of health and appetite, it should be the recognized duty of the catering officer to visit the wards and the ward kitchens at meal times and to ensure that the food reaches the patient in an appetizing condition. Another matter which the Committee wishes to stress is the desirability of arranging, as has already been done successfully in at least one large hospital, canteen facilities for patients attending out-patient departments.

4. FOOD HABITS

254.] The Committee wishes to draw attention to a special psychological aspect of nutrition which may be of considerable importance. It may be that the present diet, even if theoretically adequate, is made less than adequate by reason of various attitudes towards it, resulting from the traditional pattern of food tastes and habits common to the British people. Might not another nation accustomed to a relatively monotonous diet live well on the present British food, whereas the British people, with their traditional ideas, may not thrive—or may easily be persuaded that their health is suffering?

255.] A community accustomed to a high fat consumption may be seriously disturbed by lack of it. Fat has a greater repletion and satisfaction value than carbohydrate; it is not uncommon to hear the remark that "meals don't stay with you as they used to". Further, the high energy value of fat means that the stomach need not be overloaded; and this is an important consideration where heavy physical work is performed, as there may be a tendency not to increase the carbohydrate intake to replace the shortage of fats. Again, a people that has grown accustomed to masticate its bread with a spread of fat finds it almost intolerable to take its bread dry. This may lead in some instances to under-feeding through sheer boredom with the food, and thus to a gradual decline in calories ingested. It is not suggested that this has happened to any marked extent; but a gradual and imperceptible fall in calories and so in output is possible.

* Circular 44/45.

256.] There seems no question of the very high value placed on meat by the British consumer, especially by men in several industries. It is held that meat is the main source of energy or is at least an essential source of stamina, although the fact that many peoples in the world seem able to perform considerable tasks upon a traditionally low fat and meat diet suggests that these foods are not essential in large amounts.*

Changing Food Habits

257.] If established food habits have an important influence on the adequacy of the diet, it seems desirable to discover whether any fundamental changes in these habits have resulted from the diet of recent years. In a period of shortages any adjustment made by the consumers may be of a temporary nature. How far, then, is it safe to conclude that any observed changes are in any sense permanent?

258.] Food habits plainly differ from one part of the country to another and from one income group to another. In some regions the consumer appears to be more adaptable and less bound by traditional notions. For example, it is possible that workers in the south-east of the country are a more mixed population, more readily affected by changes in the middle-class pattern of diet, more accustomed to a variety of foods in the shops and eating-houses.

259.] Evidence might be sought of the varying demand for certain points foods in different parts of the country. Allowance would have to be made for the availability of the foods studied. Increased or decreased demand for dried milk, dried eggs, oatmeal and rolled oats, dried peas and certain canned foods would provide some indication of the change in popularity and therefore of the flexibility of habits among consumers. A change in the demand for certain dishes in canteens and restaurants would presumably indicate that such dishes are becoming more or perhaps less popular. In the nature of things there are very few dishes that could at present be subjected to this test; but the most important are (*a*) made-up cheese dishes, (*b*) boiled and grilled fish, (*c*) various vegetables, and (*d*) salads.

260.] The Committee considers that in this matter of changing food habits attention should be concentrated in the first instance mainly upon the age-group fifteen to twenty-five years. This is proposed for three reasons. First, this group includes the parents of the near future, and any change in its tastes and habits is bound to have its effect upon the coming generation and to reflect a more or less permanent adaptation. Secondly, this age-group has been influenced directly or indirectly by the growth of the school meals and school milk services; a study of it should reveal how far these services have had an effect on tastes. Finally, this age-group has matured in a period of shortages and to some extent under conditions of army life. It must therefore have tended to make its own adjustments to these abnormal circumstances.

261.] A thorough investigation of changing food habits would take much time and should be undertaken by experienced workers. The Committee recommends that such an inquiry should be arranged.

* See paragraphs 37–48.

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VI RECOMMENDATIONS*

(1) The Committee wishes to draw attention to the need for more detailed information concerning the range of individual energy requirements within groups of the population, divided according to sex, age and occupation. Of particular importance is the need for more information about the range of calorie expenditure among groups of men and women engaged in differing types and degrees of physical effort. The Committee recommends that inquiries be instituted with a view to obtaining this information.

(2) The Committee believes that much of great value to industrial workers would be revealed by a comprehensive study of the relation of the distribution of the day's calorie intake to efficiency of work, particularly in heavy industries. It recommends that encouragement be given to studies of this character.

(3) The Committee wishes to emphasize the value of family and individual food surveys in ascertaining the food consumption of different sections and classes of the population. It is concerned by the present lack of data, and recommends that the appropriate authorities provide machinery for ascertaining at regular intervals the consumption of food by groups and individuals representing as widely as possible the different sections and classes of the population. The collection of such data would (i) provide information about the variations from the average food consumption of different groups; (ii) detect any groups and individuals who may be consuming diets which are insufficient; and (iii) provide, in conjunction with clinical surveys, an important means of gaining reasonably accurate knowledge about nutritional requirements.

(4) The Committee urges that every effort be made to devise reliable methods of assessing by clinical (including anthropometric and biochemical) procedures the state of nutrition of the population.

(5) While recognizing the necessity of control of the purchase of food during the present period of shortage, the Committee emphasizes the desirability of increasing the supply and variety of foods, and of removing all restrictions on the purchase of food as soon as this can be done without detriment to the nutrition of any section of the world population.

(6) The Committee recommends that the appropriate Government authorities consider the advisability of:—

(i) providing the priority allocation of food (and especially of milk) free of charge for consumption by school children in their own homes during the school holiday periods;

(ii) making any practicable arrangements to supply additional allowances of food for consumption at home by those industrial workers to whom works canteen or similar services are not available at or near their place of employment, and adolescents in employment of any description where there are no canteen or civic restaurant facilities;

* The detailed recommendations of the Committee as to dietary allowances are contained in Section II and summarized in Appendix A.

(iii) promoting the speediest possible extension, under the National Assistance Act, 1948, of meals delivery services for old people, and provision of residential establishments for the domestic care of those old people whose nutrition problems are aggravated by the conditions in which they live at present;

(iv) taking still further action to promote the organization of special catering departments in hospitals under the supervision of trained catering officers, who should be responsible for the feeding arrangements at all stages, from the buying of the food to the service of meals to the patients; and to promote also the institution of canteen facilities for out-patients;

(v) arranging for prospective teachers of domestic science in schools to be made well acquainted during their training with the home background of the ordinary pupil; and for a more generous supply of foodstuffs to be provided for cookery demonstrations;

(vi) instituting an inquiry by competent investigators into any fundamental changes in food habits which may have occurred among young people aged 15 to 25 as a result of the diet of recent years.

APPENDIX E

ACKNOWLEDGMENTS

The Committee wishes to record its gratitude to all who have helped it by providing information or expert advice. It is particularly indebted to the advisers from Government Departments—Dr. E. R. Bransby, Mr. C. J. Brown, Dr. K. G. Fenelon, Dr. H. E. Magee and Dr. Percy Stocks—who devoted much time and labour to the work of the Committee and gave invaluable and indispensable help. Special thanks are due also to Mr. F. Le Gros Clark and Dr. F. Yates, who assisted Sub-committees as co-opted members, and to Dr. D. P. Cuthbertson, Dr. P. M. D'Arcy Hart, Dr. Isabella Leitch and Mr. Patrick Slater, who attended meetings of Sub-committees to discuss matters of which they have expert knowledge. For permission to examine and to publish a large amount of material derived from the National Food Survey the Committee records its thanks to the Ministry of Food. The Committee had the advantage of being able to study a mass of valuable data collected by the Oxford Nutrition Survey, and many of the figures relating to nutritional requirements which it finally adopted were those chosen by the Survey. The Committee is indebted to Dr. H. M. Sinclair for permission to publish Table I(b) in Appendix A, which is taken from a forthcoming publication of his; to Dr. G. E. Friend and Dr. T. L. Scott for supplying records kept at Christ's Hospital School (including statistics taken from the forthcoming second edition of Dr. Friend's book, *The Schoolboy: His Nutrition and Development*); to Dr. J. N. Morris and Mr. J. Longden for preparing Figures II and III in Appendix D; and to Miss D. F. Hollingsworth, of the Scientific Adviser's Division of the Ministry of Food, for making the calculations given in paragraph 65. The Committee records its appreciation of the action of the Food and Nutrition Board of the U.S. National Research Council in placing at its disposal before it was made public the report of the 1948 revision of "Recommended Dietary Allowances", which was of considerable interest and help.

The Committee is indebted also to the following persons for advice or information: H.M. Chief Inspector of Factories, the Commissioners of the Metropolitan Police, Mr. Pelham Borley, Capt. H. Brierley, Mr. P. H. Constable, Professor F. A. E. Crew, Dr. T. A. Lloyd Davies, Mr. W. D. Doherty, Dr. O. M. Holden, Dr. S. K. Kon, Mr. J. A. H. Lee, Professor T. McKeown, Dr. P. L. McKinlay, Professor J. M. Mackintosh, Mr. K. A. F. Miles and Professor J. A. Ryle.

Finally, the Committee wishes to express its thanks for the help received from certain members of Women's Voluntary Services in Glasgow, Liverpool and London.

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Germany

Schimmel & *Co.* at Miltitz (near Leipzig) have been cultivating varieties of *R. damascena* and *R. centifolia*, besides other roses, since 1886 in the fields attached to their factory. The production of otto of rose from the flowers harvested is limited.

Commercial otto of rose produced in Germany has the following constants: sp. gr. $\frac{15^\circ}{15^\circ}$, 0·849-0·863; $[\alpha]$, -1° to $+4^\circ$; n. 1·452 to 1·464; congealing point, $+18^\circ$ to $+23·5^\circ$; acid val., up to 3; ester val., 7-16; and total geraniol, 66-75%; the otto contains up to 32% stearoptene.

Schimmel & *Co.* have put on the market an artificial rose oil, under the name Rose Schimmel & Co., with the true rose odour. The discerning user of perfumes prefers this product to the true otto and there is a sizeable trade in this product.

Italy

The cultivation of roses in Italy is of recent origin. It is confined to the Ligurian region where oranges and lemons were once being intensively cultivated.

The primary interest in rose cultivation is the supply of cut flowers to foreign markets; the use of flowers for perfumery purposes is of secondary interest. The area under rose has expanded in Western Liguria from a few hectares in 1900 to about 450 hectares (1,215 acres) in 1925.

The varieties cultivated in the Ligurian Riviera are Ulrich Brunner, Drushky, Nabonnand, Vanhoutte, Safrano and Mocka. The principal centres of cultivation are San Remo, Ospedaletti, Colderodi, Poggio, Latte and Vallebona. Rose de Mai has been introduced recently at Vallecrosia. The soils of Arroscia, Impero, Prino and Nervia are especially favourable for the cultivation of this rose. The area under Rose de Mai in 1925 was 40 hectares, of which 10 were in use for several years; the remaining area was under development.

Before and immediately after the first World War, roses were being sold at 10-15 centims per kg. The prices were so low that buyers from Grasse were prepared to bear even the transport charges. With the establishment of a factory at Vallecrosia for the manufacture of raw materials for perfumery, the prices increased. While the export of flowers to Grasse decreased, the demand for Rose de Mai increased. Large quantities of Rose Brunner were being despatched from Italy to other countries.

Roses are cultivated at altitudes not exceeding 600 metres. They are propagated by suckers or boutures, usually by the latter. Boutures are planted in autumn or spring in well-worked ground and frequently watered for some days. The number of plants per hectare is 1,500. Rose de Mai plants are arranged in the form of an arch in the second year; other types are left as bushes. The plants are pruned and tended like other cutters. Light watering before flowering has been found to increase yields. Flowers are gathered in the morning by experienced pickers who pick the flowers by means of a chalice and collect them in baskets or sacks. Collected flowers are carefully transported to the factory site.

There were four factories in Italy after the first World War. There are two now, one at San Remo and the other at Vallecrosia. Otto of rose is obtained by subjecting the flowers to steam distillation; a patented hydrocarbon process is also in use in the Vallecrosia factory.

Morocco

The rose has been a favourite of the Moors since its introduction in Morocco by Arabs in the seventh century A.D. It has been grown in cities and villages for ornamental purposes and for the distillation of rose water.

The rose cultivated in Marrakesh is *R. centifolia*, the species cultivated in Southern France. The plants are grown at much higher altitudes than in the Grasse region. They resist wide variations in temperature and also drought and rust. *R. damascena* Mill. is grown in the southern parts of Morocco.

The chief localities of rose cultivation lie between the high Atlas in the north and Djebel Sarro in the south. The plants are grown in rows between trees and as hedges surrounding

cultivated fields. The bushes attain a height of 6 ft. and flower profusely. Roses are collected in March and April before the buds open and dried in the sun. Five kg. of fresh buds give about 1 kg. of the dried product. Three grades of buds are recognized, namely, *Daddes*, *Skoura* and *Glaocea*, the first being the best. Marrakesh is the principle centre of trade. Before World War II, Morocco produced 400 to 750 metric tons of dried rose buds per year of which one third was exported to Marseilles and New York, the rest being used locally for the preparation of rose water. The rose oil obtained by the hydro-distillation of dried buds (yield, 0·03%) is greenish in colour with a characteristic, somewhat unpleasant, hay-like odour. A dark green, semi-solid concrete (m.p. 46-47°C.) is obtained by extracting dried rose buds with petroleum ether. This on steam distillation yields 1·05 per cent of a volatile oil.

A factory has been established at Sabaa-Aiown for the production of rose oil and rose concrete from dried rose buds. The products obtained have different characteristics from those of Grasse products.

A thornless variety of *R. centifolia* has been cultivated under ideal conditions over several acres of land near Mekuesat (altitude, 1,800 ft.) and the flowers employed for the commercial production of rose oil. The oil has a yellow or slightly greenish colour and a delicate odour differing quite markedly from the Bulgarian rose oil. The production of oil is quite small and it has not come to be known in the trade. The oil may well serve as a replacement for the expensive (distilled) Rose de Mai oil from Grasse, the production of which has been practicably abandoned in favour of the (extracted) concrete.

Large scale plantation of *R. centifolia*, from vigorous stocks obtained from Grasse, has been established in Khemisset (between Rabat and Meknes) by an experienced essential oil manufacturer from Southern France. The plantation was started in 1941; 4,000 cuttings were planted on each hectare and shoots allowed to develop horizontally. Special cultural techniques of dry farming (frequent tillage, dressing, etc.) have been adopted to obviate the rust disease. The yield of roses, which are being harvested since 1950, was as good as that in the Grasse region. The harvest lasts for almost two months in Khemisset, whereas in Grasse it lasts only for two weeks. The yield of concrete is *c.* 2 kg. from 1,000 kg. of flowers (which is somewhat lower than that reported from Grasse) and perfumers have reported favourably on the concretes and absolutes produced in Khemisset.

Turkey

Roses have been cultivated in Asia Minor since ancient times and rose water has been extensively employed for flavouring confectionery, as a cosmetic, and in medicine. *R. damascena* was introduced into Turkey in 1894 by a Bulgarian peasant of Turkish descent, who is reported to have smuggled the cuttings of the plant from Bulgaria. The Ministry of Agriculture distributed in 1900, one lakh of plants of good stock to agriculturists in several provinces and granted loans on easy terms to producers of oil for purchasing equipment. About 800 kg. of rose oil were being produced in the years immediately preceding World War I. The industry suffered a setback during the war but recovered soon after. The production at present varies from 100 to 300 kg. per year.

The centres of rose cultivation are situated in the south-west of Anatolia, particularly in the Vilayets of Burdur and Isparta. The main centre of production is Atabey. Biledjik, Antalya, Konia, Brussa, Aidin, Kutahia, Afion and Karahissar are other rose-growing areas. About 450 hectares were under rose cultivation in 1933. The annual production of roses is about 675 metric tons, comprising 250 tons each in Isparta and Atabey, and 175 tons in Kecibarlu. There were about 1,100 rose field owners in Isparta and Burdur in 1937.

R. damascena is the principal variety cultivated in Anatolia. *R. alba* and the thornless rose, called *Hafis*, are cultivated to a small extent. The latter gives a high yield of oil, but the quality of the oil is inferior to that from *R. damascena*. The oil is used as an adulterant of high grade oil.

The soil of Anatolia is clayey, rich in humus and slightly sandy. Rose gardens are laid out on the slopes of hills (2,500-3,250 ft.). The ground is ploughed to a depth of 50-60 cm.,

ditches 35-40 cm. deep and 60-70 cm. wide are dug 1·5 meters apart and fertilisers are liberally applied; 13,000-15,000 cuttings are planted per hectare in spring. Flowers are harvested in May-June from the third year onwards and good yields are obtained after the fifth year. The bushes continue to bear for 20-25 years.

Distillation is usually carried out in small stills resembling those used in Bulgaria; stills of *c.* 1,000 litres capacity are also used in a few places. The ratio of flowers to water is 1 : 10 and the average yield of oil is about 1 kg. for 3,000 kg. of roses. A large modern distillery using steam heating and with a daily capacity of 30 metric tons of roses was established by the Government in 1934. This factory produced about 20 per cent of the total production of Turkey in 1938.

Adulteration of the oil is not infrequent and the Anatolian product has not been favourably received in trade circles (Guenther[2], 35-38).

U.S.A.

Large scale cultivation of roses for the production of rose oil has been started in recent years in the State of Texas in U.S.A. It is proposed to develop the Texas rose fields as a source of domestic rose oil.

Roses are cultivated extensively throughout the city of Portland in Oregon State. Portland is ideally suited for rose culture.

U.S.S.R.

The first rose garden covering six dessiatimes (16·2 acres) was laid out in 1898 near Paveula, where a distillery for the production of rose oil was also established. Cultivation of a semi-double, strongly scented rose of Persian origin was started in the Transcaucasus region later. Plantations of Kazanlik roses have been established in other districts, particularly near Raevsk, Tremyuksk, Gelendshik and New Athens. A factory for producing rose oil and rose water is in operation in New Athens.

The rose oil industry in the Kuban district of N. Caucasus is being rapidly expanded. The Five Year Plan of 1946 called for an increase in the area under roses to 350 hectares. According to press reports the harvest of flowers in 1946 amounted to 150 tons.

The Soviet production method of rose oil consists in steam distilling the petals, separating the initial oil and absorption of the soluble oil with active carbon with eventual desorption by an organic solvent.[3]

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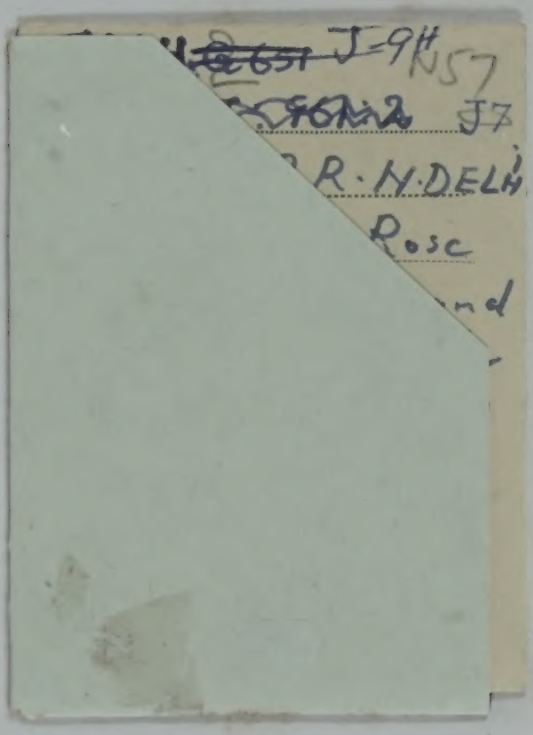
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